THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LX. No. 1534.] LONDON, OCTOBER 4, 1892. [44TH YEAR. PRICE 6d.

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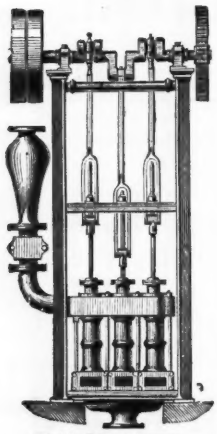

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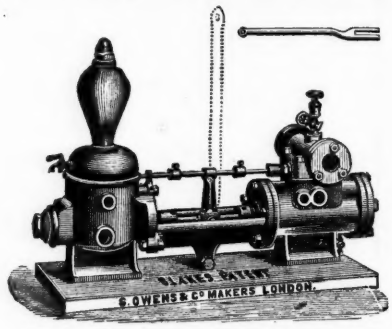

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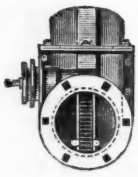

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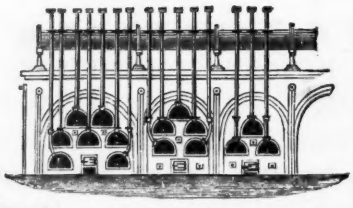

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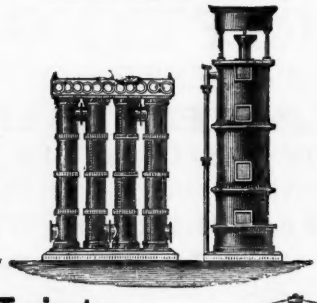

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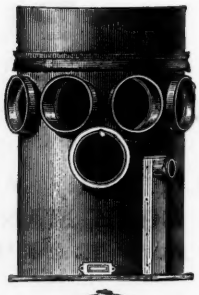

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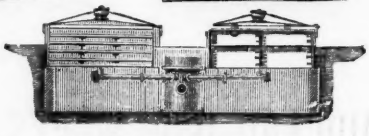

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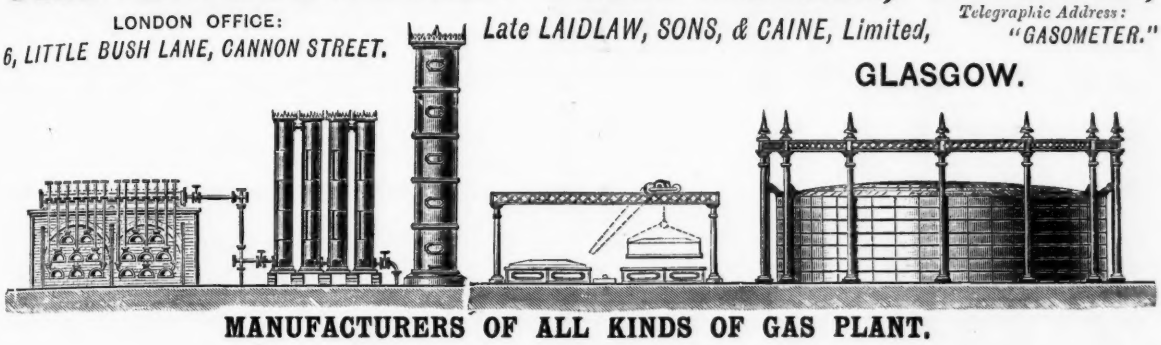

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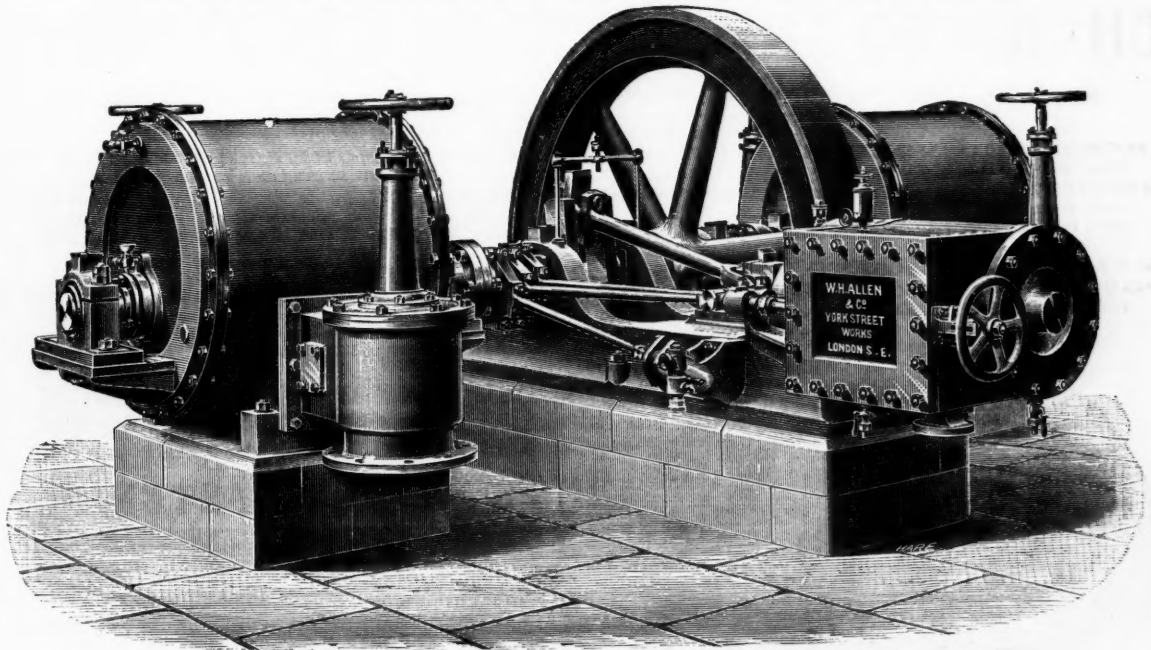

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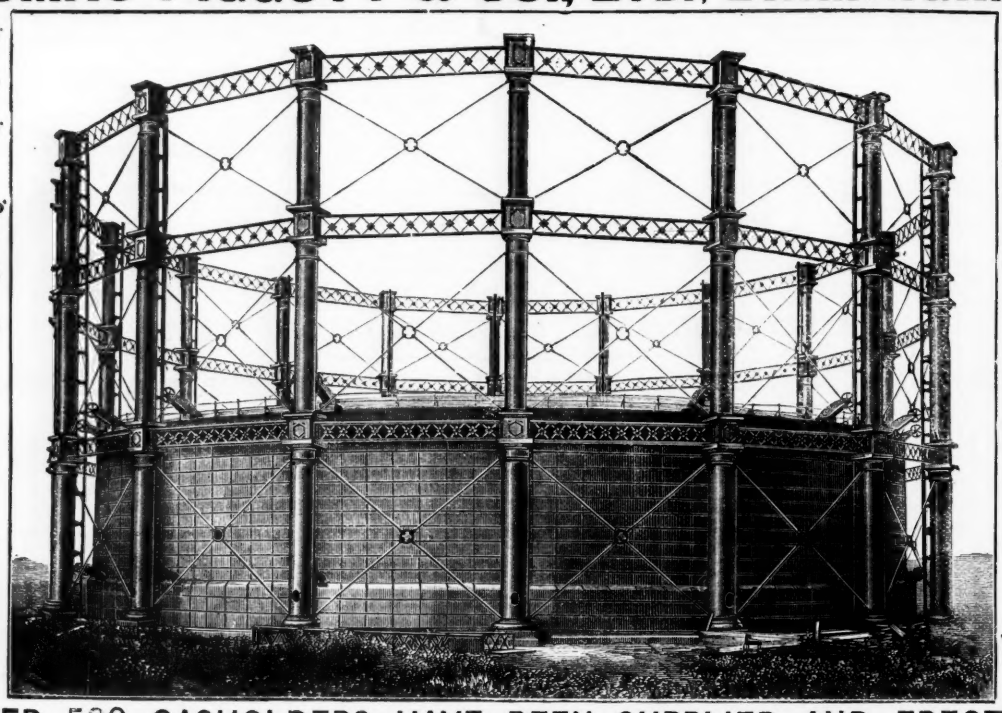

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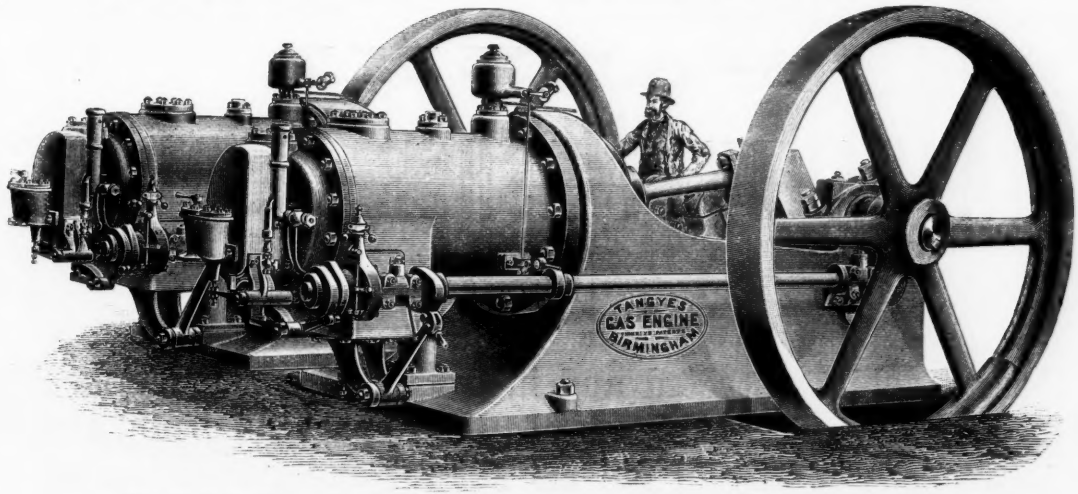

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"STANDARD" WASHER-SCRUBBER.

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I am, yours truly,
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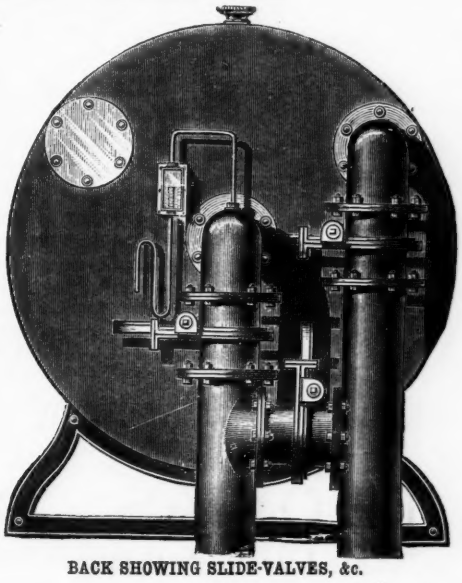
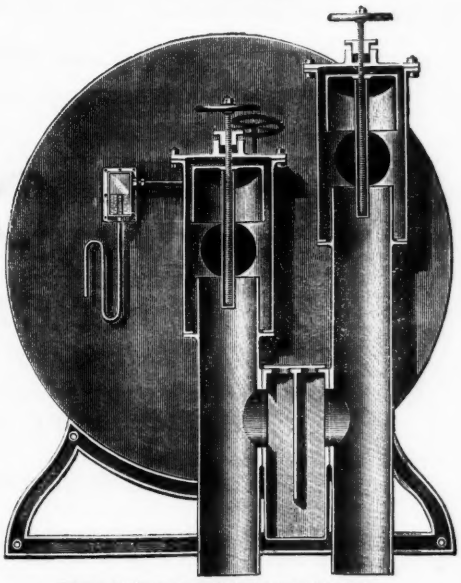
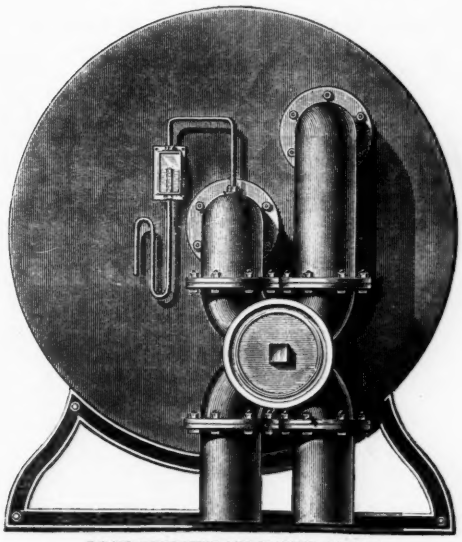


BACK SHOWING SLIDE-VALVES, &c.



BACK SHOWING HYDRAULIC VALVES.



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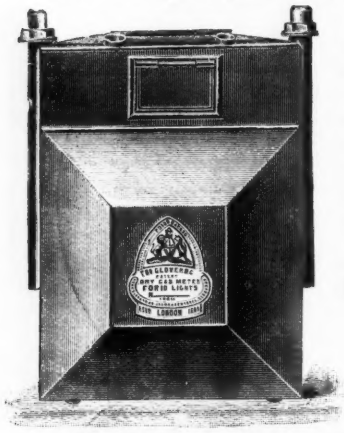

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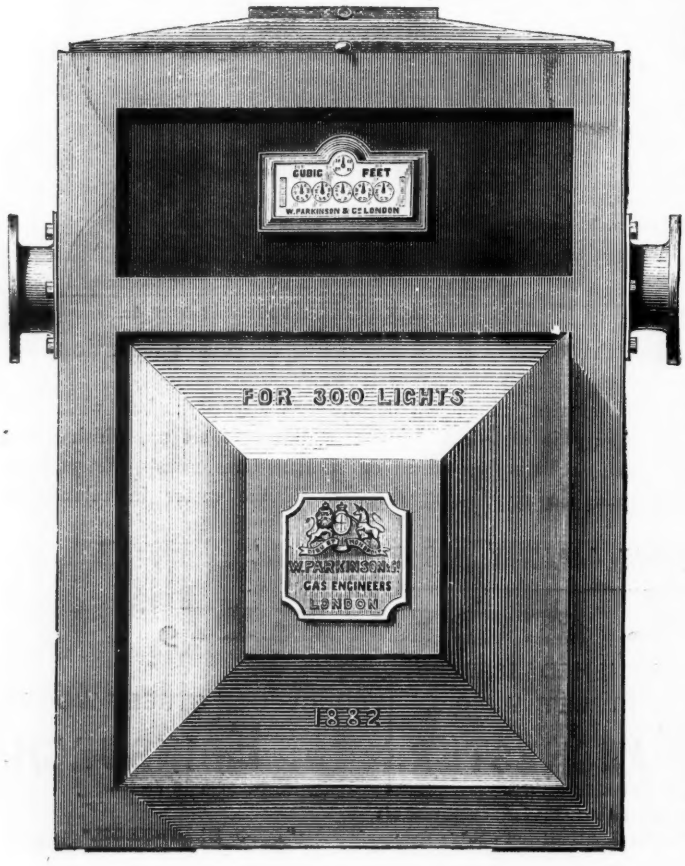

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, OCTOBER 4, 1892.

French Gas Companies—The Proportion of Borrowed to Share Capital.

THERE has been during the past year or so a considerable amount of negotiation between French Local Authorities and the Central Government, respecting the licensing of gas and water mains in the national and the communal roads. In France there are two classes of highways—the one comprising the great lines of communication between the towns and throughout the country, which are under the control of the State, even where they traverse the districts of Local Authorities; and the other including all branch roads and streets, these being in charge of the latter authorities alone. Consequently, in cases of gas concessions by French Municipalities, the right to lay mains has been restricted to the municipal roads—the necessary permission for touching the main thoroughfares having to be obtained separately. This species of "dual "control," as might be expected, has occasionally led to difficulties, and in some instances we believe it has furnished the opportunity for competition in gas supply—one company having the concession from the Local Authority, and another the patronage of the Central Government. Even where matters have not proceeded to this extreme, it has been found possible, by concerted action between M. le Préfet and M. le Maire, to bring pressure upon gas companies; because, as we understand it, although a municipality may bind itself, by the grant of a concession, to one company, the licence for main-laying in the national roads is only accorded during pleasure. Consequently, by the threat of a revocation of this governmental sanction, which, of course, covers the lighting business in the best thoroughfares, any French provincial gas company could be rendered very uncomfortable. On the other hand, so long as the administrators of a gas company could keep the favour of the Prefect, they were to this extent independent of the Local Authority. As the result of the negotiations upon this subject to which reference has already been made, it now appears that the French Government has yielded the point of highway control, so far as the licensing of gas and water distributing plant is concerned, to the Local Authorities, who will therefore in future enjoy plenary powers in this regard over all the roads and streets within their districts. It will still be possible, however, to appeal to the State in any case where a Municipality seeks to make an inequitable use of this extended power. We gather from the *Journal de l'Eclairage au Gaz* that this solution of a long-standing question is not regarded unfavourably by the French gas interest.

Passing from the immediate subject of the action of the State, our contemporary proceeds to make some instructive comments upon the general question of competition in gas supply, out of which this particular transaction grew. It is remarked that the recrudescence, in some places, of popular feeling in favour of competition really originates in the tradition that all gas companies pay their shareholders enormous dividends. This prevalent impression our contemporary shows to be far from the truth; stating that out of the 804 undertakings supplying the 1028 French communes actually lighted by gas, only 13 can be classified as very flourishing, 87 are worthy to be called flourishing, 313 merely return the ordinary profit of stable industries, and the remainder with difficulty pay their shareholders from 4 to 6 per cent. Besides, it should be borne in mind, with reference to this return, that there is a difference between the share dividends and the burden of interest paid upon the whole capital employed in the gas industry. It is asserted that in France the share capital of gas companies does not represent at the most more than from one-third to one-half of the total capital, while it guarantees to the bondholders or the mortgagees the interest and the redemption of their advances before its owners can touch any return. If, under ordinary conditions and during times of prosperity, this guarantee does not weigh upon the shareholders, the case is altered whenever temporary or permanent difficulties make the preferential right of the bondholders felt by the shareholders. It is therefore only fair that the latter should receive a better return than the former; while the fact of the bonds coming before a good paying share capital enables money to be cheaply borrowed. The statistics published in France do not permit of the determination of the mean return received upon the capital employed in the gas industry; but it is supposed to be certainly not more than 7 per cent.

Our contemporary goes on to demonstrate that competition in gas supply would not in France have the result of lowering the price of gas. It is unnecessary for us to follow these reasonings, which are conclusive enough. The object we had in view in referring to the subject here, apart from that of recording an interesting statement relating to the circumstances of the gas industry in France,

was to draw attention to the large preponderance of borrowed capital employed by French gas companies, which far transcends what is customary in this country. What is in reality the best proportion of loan to share capital is hardly to be fixed with regard to general considerations for all British gas undertakings. As is well known, when the generality of gas companies go to Parliament for increased capital facilities, they are usually permitted to raise by borrowing an amount equal to one-fourth of the share capital actually paid up for the time being. Some are empowered to raise as much as one-third of the amount of their new share capital by way of loan; Parliament having of late years recognized that this is a cheap way of obtaining the money needed for gas-works extensions. It seems to be questionable how far this process might be advantageously extended, and those English companies who are now preparing Money Bills for next session might consider the point.

Birmingham Gas Affairs.

CERTAIN interesting matters in connection with the gas undertaking of the Birmingham Corporation are to come before the City Council to-day, as will be seen from a report which will be found in another column. The most important of these arises in connection with the rearrangement of the chemical branch of the Saltley establishment, consequent upon the removal of Mr. T. H. Hack, who has hitherto been the Analyst and Gas Tester for these works, to Sheffield, where he has an appointment under the Gas Company. The Chemist's department will now be completely reorganized, and placed under a trained Chemist in the person of Dr. Colman, who is to receive a salary of £300 a year, and part of whose time is expressly stipulated to be devoted to research. An Assistant-Chemist is to be appointed to do the more routine portion of the work; but the department will be under the immediate supervision of Dr. Colman. This is a step in the right direction; and we have once more to offer our best congratulations to the Birmingham Gas Committee upon the worthy manner in which they are vindicating their right to the custody of the great property entrusted to their charge. While some Local Authorities, who shall for the present be nameless, elect to carry on their undertakings in the "cheap and nasty" style, Birmingham is manifestly not disposed to be so "penny wise and "pound foolish." It is particularly to be noted that the Birmingham Superintending Chemist is to be employed largely—in point of fact, almost wholly—upon "research." This is a most encouraging resolution. It signifies that the Gas Committee do not expect what are called "practical"—meaning immediately saleable—results from the work of their Chemist. He is enjoined to seek after truth by means of the scientific methods of which he is master; leaving the "practical results" to come after. It is a curious coincidence that, at the very time when the Committee must have had this appointment finally under consideration, we should, unknowingly, have been engaged in recording among "Gleanings from the British Associa-"tion" those eloquent words of Von Hofmann which Professor M'Leod repeated before the Chemical Section for the encouragement of devoted inquirers after truth, and which must have seemed specially applicable to the Birmingham project.

It is also noteworthy that the Birmingham Gas Committee have been enabled, by the help of carburetting with oil, to shake off the domination of certain coal contractors, whose terms were such as would have entailed a rise in the price of gas. A little further light is thrown by this experience of the Committee upon the question of trade combinations. The Committee had good reason to believe that the value of gas coal was falling; and, as a matter of fact, they were able to arrange for supplies for two of their works at a "reasonable and satisfactory" reduction from last year's prices. As for the remaining two works, it appeared that plenty of coal was to be had, but that the contractors had made up their minds not to supply at the reduced prices contemplated by the Committee. The coalowners, in short, undertook to make and maintain a "corner" in the particular class of coal which the Committee had been in the habit of purchasing; depending upon the belief that the Committee would not be able to buy elsewhere what they wanted. Unfortunately for the "corner men," the Committee happen to be served by officers who know all about the modern resources of gas manufacture; and although the Committee, as they admit, hesitated to place dependence upon new sources of supply, they ultimately trusted in their advisers, and, as the result, the scheming contractors have had their coal left upon their hands. It is simply a matter of business. The coal people took their chance, and have overstayed their market. With regard to the way found by the Birmingham Gas Committee out of the difficulty, it is hardly too much to ascribe it mainly to the circumstance of their being well advised. If they had gone upon the principle already referred to as favoured by some gas-works administrators, who pretend to manage their works themselves through the intermediary of foremen, in order to save engineers' salaries, in all probability the coalowners would have won what they played for, and the gas consumers and ratepayers of the district would have had to pay thousands of pounds for their rulers' "economy" of a few hundreds.

The Affairs of the Commercial Gas Company.

THE report of the Directors and the statement of accounts relating to the working of the Commercial Gas Company for the half year ending June 30 last have been issued; the ordinary general meeting of proprietors being fixed for Friday next. The report is as colourless as usual—merely summarizing the results shown by the accounts. The half-year's working has returned a net profit of £22,285; making, with £495 odd received for interest, a total of £22,781, which is increased to £41,275 by the amount brought forward from previous accounts. Deducting the sum of £2925 required to pay the interest on debenture stock, there remains to the credit of the net revenue account a balance of £38,350 available for division. This, being less than is required to meet the dividends after the rate of 13 and 10 per cent. recommended by the Directors, necessitates a draw upon the reserve fund to the extent of upwards of £5000 to make up the deficiency. Thus the whole of the unappropriated balance has at length disappeared; and the report goes on to state that the inevitable step of still further raising the price of gas has been taken as from Michaelmas. The Board are deserving of much credit for struggling as they have done against this result; but circumstances have proved too strong for them. The accounts are not very reassuring as to an early return of the days of lowest prices. By increasing the charge from 2s. 4d. to 2s. 6d., the rental was lifted from £120,872 to £124,164; but the quantity of gas sold only exceeded that for the corresponding half of last year by a little more than 3½ million cubic feet. While upon this subject, it should be remarked that there has been a good "pull up" in the proportion of accounted-for gas; the increased sales being made from a make diminished by about 10 million cubic feet. Residuals show a sad falling off. Coke has dropped from £33,382 to £23,613; tar, from £9975 to £6760; and ammonia, from £10,230 to £9099—the usual separate entry for breeze having changed its character from profit to loss. On the other side of the account, coals fell from £87,749 to £82,459. In this connection, it is to be observed that, although the Company still carbonized 2920 tons of cannel, which is a luxury they have been prone to indulge in, there has been a great change in this point of working. They have taken to oil carburetting, like their neighbours; but even with the petroleum used, their bill for carburetting materials is much reduced. Remarkably enough, however, although the total weight of coal carbonized has decreased by 307 tons, the carbonizing wages have gone up from £20,126, to £20,133. The advance is only nominal, it is true; but there should have been a saving. Is it due to the works being Union-ridden? An explanation seems to be called for. It appears from the insurance fund account that the Company have taken from this fund the extra cost of coal, amounting to £4175, due to the Durham strike. If it had not been for this assistance, the revenue account, poor as it is, would have presented a miserable balance indeed.

The North of England Meeting.

THE members of the North of England Gas Managers' Association had a pleasant meeting on Saturday at Seaham Harbour, under the presidency of Mr. J. Whyte, who entertained the party at the gas-works, after which the presidential address, reproduced in another column, was delivered, and papers by Mr. H. Tobey, of Malton, on

"Asphalte Paving," and Mr. T. Bower, of West Hartlepool, on "Tar as Fuel," were read, and the former was discussed. A drive was taken through the interesting neighbourhood of the port; and in the afternoon the Directors of the Gas Company provided dinner at the Railway Station Hotel. The meeting was well attended, and the day was in all respects enjoyable, thanks mainly to the unostentatious kindness of the President and the forbearance of the weather. The character of the proceedings did credit to the reputation of the Association for quiet usefulness to the gas managers of the district served by it.

A Curiosity of Local Government.

THE reflection that our local governing bodies are not always quite perfect, is occasionally borne in upon the most fanatical admirer of democratic institutions. Engineers and architects employed by Municipal Corporations commonly have as much as they can manage to do by way of getting the chosen of the people to assign building contracts, &c., to proper hands. As we have had but too many occasions for remarking, moreover, the methods by which Local Authorities provide themselves with professional advisers are sometimes open to objection; so that what with the peculiarities attending the filling of responsible municipal appointments, and the difficulties under which the duties of these offices are carried on, it is remarkable that the ratepayers' work is done so well as it actually is in the majority of cases. We have frequently animadverted upon the bad habit of Local Authorities in the matter of requiring candidates for professional appointments to name their own price, and would fain hope that our remonstrances in this regard have not been wholly thrown away. The evils of sordid meanness and disregard of public duty perpetually change their form, however; and accordingly we were not greatly surprised to find our contemporary the *Builder* recently protesting against the outcome of the architect's competition for the Llanelly Town Hall as an illustration of the propensity of some Local Authorities to perpetrate "jobs" in the pretended interest of the public. For it is hardly sufficiently understood by the world at large that there is more than one kind of Municipal "jobbery" in the land. Usually, Municipal and Corporation jobbery means a misappropriation of public funds in some private interest; but it is almost as common to find Municipalities robbing individuals and even the community for the sake of "the "rates." Something like this appears to have been done at Llanelly. The result of the Town Hall competition here was the usual award, by a professional assessor, of first and second premiums, to say nothing of other rewards for less deserving designs; and it was further recommended that the first premiated plans should be carried out. These were unquestionably the best, for many reasons; yet when the Town Council met to settle the business, somebody moved to set aside the recommendation of the assessor, and carry out the second prize design, which was accordingly agreed to by a vote of 11 to 4. "No sufficient or "direct reason was assigned for this procedure; but when "it is mentioned that the second premiated architect was "a local man, and was willing to undertake the work at a "commission of 4 per cent. instead of 5 per cent., most "readers who understand the ways of small Corporations "in these matters will think there is no need to look "further for an explanation." It is indeed easy enough to see how a performance of this kind was in all probability "worked." The most lamentable feature of these jobs is the evidence they supply of the existence of some public bodies who have not the sense to see that, by inducing professional men to cut one another's throats, they are in a very literal sense depriving the community of the advantages of professional guidance.

Mr. T. Newbigging's "History of the Forest of Rossendale."—The *Rossendale Free Press* of last Saturday contains the first instalment of Mr. T. Newbigging's "History of the Forest of Rossendale." The work originally appeared in 1868, and was well received; but since then it has become scarce. A desire expressed by the proprietor of the above-named paper induced Mr. Newbigging to undertake the revision of the book, and to add to the record the further materials of interest he has met with, and the notes he has made, since the first edition appeared. On the completion of the publication of the "History" in serial form, it will be issued as a volume. We are sure that, in one or the other shape, it will be possessed by many of our readers, especially those residing in the Rossendale district.

WATER AND SANITARY AFFAIRS.

TO-MORROW the Royal Commissioners appointed to investigate the subject of the Metropolitan Water Supply will resume their public proceedings. According to present arrangements, three days are to be devoted this week to the reception of engineering evidence; and in the week after next the geologists are to have an equal extent of time. A considerable array of witnesses will thus make their appearance; all being more or less celebrated for their special qualifications. A curious incident in connection with this inquiry consists in the application made to the Commissioners by the St. Saviour's District Board of Works, to be allowed to send two witnesses to give evidence as to the quality of the water. The local Analyst for St. Saviour's, Southwark (Mr. R. Bodmer), has reported to the District Board that two samples of water which he has examined—one taken from the mains of the Southwark and Vauxhall Company, and the other from those of the Lambeth Company—prove to be "decidedly "impure," and only require to be a little more so in order to be "condemned as unfit for drinking." Such is the evidence which the St. Saviour's District Board desire to lay before the Royal Commission; and in the meantime a copy of the Analyst's report has been sent to the Local Government Board and the County Council, as well as to the Vestries and District Boards in the area supplied by the two Companies specified. The fact is recognized at St. Saviour's that Mr. Bodmer's report is "very different" from the report of the Local Government Board for the period in question. It is not the first time that this kind of contradiction has presented itself; and it has always been in reference to one or other of the two Companies mentioned. We hope the discrepancy will now be promptly cleared up, and that we shall not hear of any more local analyses being put in opposition to the reports of Dr. Frankland and other eminent chemists. If first-class experts like Dr. Frankland, Mr. Crookes, and Dr. Odling, testify to a "high degree of organic purity" in the supply, while somebody else asserts that the water is so impure as to be almost unfit for drinking, there must be a serious error somewhere. If scientific analyses from the best authorities are good for nothing, where are we to place our confidence? If Dr. Frankland can err, is Mr. Bodmer likely to be right? Mr. Louttit, as Secretary and General Manager of the Lambeth Water Company, has written to *The Times* to show how thoroughly the character of the supply is vindicated by the reports of official and semi-official analysts. The Lambeth Company had no opportunity of checking Mr. Bodmer's analysis, as they had no knowledge of his proceedings until his report appeared in the papers. It would have been better if, at the time Mr. Bodmer's sample was taken, the Company had been placed in a position to secure a duplicate. But there is evidence enough to show that the supply given by both the Lambeth and the Southwark Companies is perfectly wholesome, unless we are to abandon all faith in chemical analysis, even when conducted by those best qualified for its performance.

The St. Saviour's District Board have not only placed themselves in conflict with Dr. Frankland, but they are coming into collision with General Scott. They are sending a request to the London County Council that inspectors shall be appointed to examine the filter-beds of the Lambeth and Southwark and Vauxhall Companies, "to see "that the water is effectually filtered before being "delivered." These gentlemen, who sit in a Board-room in Southwark, seem unaware of the fact that, in accordance with the Metropolis Water Act of 1871, the Local Government Board, as taking the place of the Board of Trade, have appointed "a Water Examiner, being a competent "and impartial person," whose duty it is to see that the water is subjected to efficient filtration, as prescribed by the Metropolis Water Act of 1852. If they like, the Southwark authorities can read the monthly reports of General Scott, who some years ago succeeded Sir Francis Bolton as the Metropolitan Water Examiner; and they can acquaint themselves, through these documents, with all particulars relative to the filtration of the supply, even to an inch in the thickness of the layers of sand, shells, gravel, and other material used in the composition of the filter-beds. If inspectors of the filter-beds are to be appointed by the County Council, then, of course, there is an end to General Scott, who will no longer be wanted. Only

it happens that General Scott is established by law; and we fancy the County Council have no power to appoint such officers as we find proposed by the Board of St. Saviour's. We would suggest, as likely to confer some advantage on the consumers, that the District Board should themselves appoint inspectors of house cisterns and tanks, where we think they will occasionally find an amount of pollution requiring no chemical science for its detection. Is it known in Southwark that the Paris Municipal Council have just voted 4000 francs, to defray the cost of sending a deputation to this country for the purpose of studying the system of filtration and reservoirs adopted in London and Glasgow? We believe some of these French visitors are already in London; and perhaps their report, when they return to their own country, will tend to enlighten and re-assure the agitated members of the St. Saviour's District Board of Works. As a further contribution to the question of purity in connection with the Metropolitan Water Supply, we may refer to the annual report of the Conservators of the Thames, issued last week. While General Scott watches the process of filtration, the Conservators are at work to promote the purity of the source whence the supply is drawn—the Water Companies themselves contributing more than £18,000 to the revenues of the Thames Conservancy last year for this purpose. The Conservators report that they have carried into effect the provisions of the Acts which relate to the discharge of sewage into the river and its tributaries from towns and other places on the banks. The sewage works established at various points are also carefully looked after, as well as house-boats and steam-launches. Although the state of the Thames from the estuary to Teddington Lock, and yet higher, has nothing to do with the water supply of London, it is encouraging to know, from the reports presented to the County Council last week, that the precipitation works at the main drainage outfalls have been so successful in their operation, that the Thames below London during the past summer "has been in a "most satisfactory condition." Purity of the atmosphere is desirable, as auxiliary to purity in the water supply. If the people had, in all cases, unpolluted air in their dwellings, scarlet fever would be less prevalent than it is. This is a sphere in which the Vestries and District Boards may busy themselves to good purpose.

The Recovery of Ammonia from Blast-Furnaces.—In the course of the paper read by Sir Lowthian Bell, at the recent meeting of the Iron and Steel Institute, "On the Manufacture of Iron in its Relation to Agriculture," the principal portions of which, as far as our readers are concerned, were given last week, the author said he believed Messrs. Baird and Co. were the first to investigate the subject of the extraction of ammonia from blast-furnace gases. Mr. Henry Aitken, of Darroch, near Falkirk, has written to the papers to correct this. He says the firm named were certainly the first to erect appliances to obtain the ammonia; but he had investigated the matter, and patented the process referred to, many years before their plant was put up. The question was discussed at the meeting of the Institute held in Glasgow in 1885, as will be found from a report of the proceedings which appeared in the JOURNAL at the time (see Vol. XLVI., p. 466).

The Oil-Gas Works of the Great Eastern Railway Company.—Last Tuesday the members of the Society of Engineers paid a visit to the locomotive and carriage works of the Great Eastern Railway Company, at Stratford. These works were opened in 1847; and they now occupy a total area of 52 acres, 13 of which are covered by the shops alone. In close proximity are the works for the production of the compressed oil gas with which a large number (about 1260) of the carriages are lighted. When made, the gas is compressed to 11 atmospheres into holders, of which there are five, each capable of containing 12,500 cubic feet. The receivers on the coaches are charged to a pressure of 7 atmospheres. This is generally done at Stratford; but travelling holders are sent to various stations where carriages "sleep," so that they may be charged on the spot. The average quantity of gas made in the winter is something like 160,000 cubic feet per week at atmospheric pressure, and in summer 80,000 cubic feet per week, or about 3,000,000 cubic feet in six months. The boiler which supplies steam for working the compressing-engines burns as fuel the tar resulting from the manufacture of the gas. Liquid fuel is used in the boiler-shop for two of the rivet furnaces; it being found that the rivets are heated more quickly than with coal furnaces, and not scaled to such an extent. The furnaces are also heated to the required temperature in much less time; and the heat is more under control. The injectors are worked by air, at a pressure of 25 lbs. per square inch, from a reservoir used during the winter for the Lucigen lights. The same system is applied to locomotives in combination with solid incandescent fuel.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 610.)

THE past week has not developed anything fresh in the position of business on the Stock Exchange. Everything was very quiet in the earlier part, and prices were rather disposed to be easier; but as the settlement progressed, and finally was adjusted without any difficulties cropping up, a somewhat better tendency supervened, and small advances were effected here and there. The higher class of investment stocks continued to improve. Money found a rather better chance of employment temporarily; but as yet nothing points to a permanent change. The 2 per cent. Bank rate has completed a five months' existence. Business in the Gas Market has not shown any increase of activity—secured issues being mostly in demand; but many changes in quotation have been effected. These are uniformly better, with the single, though important, exception of Gaslight "A." The fall here, however, is only one point, and the prices of transactions marked have been very steady throughout the week. The debenture issues have advanced, as might be expected; and the 10 per cent. preferences touch a price which they have not attained for a long time past. South Metropolitans were not largely dealt in; but the "A," after being done at 277 twice, advanced 3. Commercials were quiet and unchanged. The Company's accounts for the first half of the year show that they had their full share of the unfavourable circumstances which affected the profits of gas undertakings in general during that period, necessitating a resort to the reserve fund for a portion of the dividend. This is a novel experience for the Commercial Company, though most other companies working on similar lines are pretty well used to it. Happily, with a fall in the price of coal, the worst is apparently over now. The Suburban and Provincial Companies are unchanged. The Alliance and Dublin Company's accounts show that their profits are not quite sufficient to provide a moiety of the dividend; and that the reserve fund must again be called upon to make up the deficiency. The Continental undertakings continue firm; and Unions have advanced further. Bombay has regained the ¼ it had lost; Australians are higher; and Monte Video has recovered ½. Other small variations are noted in our share list. Water is disposed to rise still; and a few further improvements have taken place.

The daily operations were: Firmness was the rule in the Gas Market on Monday, and a few minor advances were made. West Middlesex Water rose 2. Tuesday was very quiet. Gaslight "A" fell 1; but the 10 per cents. rose 2; and Continental Union preference, 2½. East London Water advanced 1; and New River debentures, 1½. Wednesday brought no greater activity, and the only change was a recovery of ¼ in Bombay new. Thursday was a busier day, and the upward movement progressed. Australian rose 2; and Gaslight 4 per cent. debentures, 1½. Friday's transactions were only limited. South Metropolitan "A" advanced 3; and Continental Union, 1. West Middlesex Water rose 2. Saturday was quiet and firm, and the only variation was an advance of 3 in Gaslight 4½ per cent. debenture.

ELECTRIC LIGHTING MEMORANDA.

The Affairs of the Brush Company—The Lighting of Smithfield—A Report concerning Carlow.

THE report of the Directors of the Brush Electrical Engineering Company for the year ending June 30 last has been issued. The profit and loss account shows a profit balance of £55,757, inclusive of the balance brought forward from the last account. After deducting the standing charges, maintenance of buildings, plant, and patents, and interest on debentures, there remains a balance of £27,660. Out of this the Directors recommend that, as in former years, £3000 shall be applied to reduce the patents and goodwill accounts, and £800 written off the preliminary and other expenses account. The residue permits the payment of a 6 per cent. dividend; leaving £753 to be carried forward. It is hardly necessary to remark that this profit has not been derived from lighting, but comes chiefly from engineering contracts. The Falcon Works at Loughborough belong to the Company; and locomotives and railway rolling stock of all kinds are made here, besides steam-engines specially designed for driving electrical machinery. The Brush Company are doing a great deal of work for the City of London Electric Lighting Company, who, as we have had previous occasion for remarking, are just now in the capital-expending stage of their existence, when all things go sweetly for the drawers and receivers of cheques. By the way, the announcement is made that the latter Company are ready to receive applications for 20,000 of their newly-sanctioned preference shares, which are offered at par. It is naively remarked that "it is intended to issue the remaining 20,000 shares towards the middle of 1893 at a premium." This is eminently a case where "man proposes" something which may or may not turn out to be practicable.

Last week a paragraph went the round of the newspapers, stating that the electric lighting of the Smithfield Markets, the

contract for which has been taken under the City Corporation by Messrs. Julius Sax and Co., is rapidly approaching completion, and will very soon be formally inaugurated by the Lady Mayoress. The conditions under which the light is to be sold to the market tenants are rightly described as "somewhat novel." It is asserted that the stall-holders are not to be put to any expense for the installation of the light upon their premises; and when it is in working order, they will be charged only the same amount as they have been paying for gas. The contract provides for 8000 lamps of 50-candle power each; and the adoption of the light will be quite optional for the tenants. In these circumstances, it is hardly too much to expect that the new system of lighting will be fairly popular in the market, to begin with; but whether the occupiers of open stalls will be content to dispense in winter with the comfortable warmth of the gas lighting, is another question. It is obvious that, upon the terms named, the success or otherwise of the electric lighting experiment will have only a partial bearing upon the general problem of the commercial prospects of electric lighting companies, since in this case the loss, if any, accruing from charging for the light at the same rate as for gas will be borne by the Corporation, for the sake, apparently, of making the market more popular than it is at present. One point in the proposed arrangement is worthy of remark—the decision to use 50-candle units for the stall lighting. The accepted need for such high-power lamps corroborates what we have all along held in these columns—that the usual 16-candle power incandescent lamp, to say nothing of the favourite 8-candle lamp of the central station electricians, is useless for shop lighting. We may ask, moreover, whether it is altogether kind of the Corporation to take such a piece of "fat" as the lighting of Smithfield ought to be, out of the hands of the City of London Company.

If the statement that is being industriously circulated by Messrs. J. E. H. Gordon and Co., Limited, the well-known electrical engineers, is correct, there is at least one town in the British Islands where the Gas Company play into the hands of the electricians. It appears that the town of Carlow, in Ireland, has for the past 14 months been the scene of an electric lighting experiment conducted by the firm above named, who claim to have made a serious inroad upon the business of the local Gas Company. However this may be, it is stated that one night very recently that Company issued a circular to the inhabitants of Carlow, informing them that any person using electricity would be at once cut off from the gas-mains. A copy of the circular was, of course, sent to the electricians' headquarters in London, and elicited in reply a telegram declaring their readiness to supply the whole town, and their intention to immediately send over all necessary materials and men to save the place from inconvenience. To their local agents Messrs. Gordon wired: "Use every effort to supply all inhabitants coerced by Gas Company, and requisition at once for all men and materials required." The fine use of local colour in the wording of this order, which was, of course, intended for publication, should be observed. The whole affair comes out in the *Electrical Review*, which appends to the report of the alleged facts the aspiration that "the action of the Carlow Gas Company will be followed by other gas companies, and thus hasten the final displacement of gas by electricity for the illumination of shops and private houses." We should like to know if the facts are as stated. If so, it will only mean that somebody connected with the Carlow Gas Company has displayed a not unnatural result of mental aberration, superinduced possibly by some troublesome consumer who has been playing fast and loose between gas and electricity. There is not the remotest chance that the same performance will be repeated in any considerable town. Gas managers in general are a patient, long-suffering race. They know that their duty is to "take a back seat" whenever an electric light speculator comes into their district. They must abide in patience when the new electric lamps flaunt their hardest in the most conspicuous shops, and must allow the gas-meters to remain for the purpose of a stand-by in case anything goes wrong with the electricity. They must, without grumbling, rest content with such crumbs of rental as meters thus used bring in; and on no account must they hint that this kind of treatment strikes them as "not good enough." It is not only for the pleasure of electricians that gas companies are called upon to fill the part of the "friend in need." Whenever a local authority thinks fit to play for awhile with street oil-lamps, the gas company must pretend to take no heed, but must go on making every necessary provision in case the authority should decide to fall back upon gas at a day's notice. In the case of powerful gas companies, the irritating vagaries of a few consumers do not disturb the even tenor of the way of the management; but in small places gas directors and managers, who remember that gas supply is only a business like any other, and who are not devoid of tradesmen's jealousy, are apt to act occasionally like angry men do all the world over in and out of gas-works—that is to say, hastily and mistakenly.

The New Scale of Patent Fees, some particulars in regard to which were given in the JOURNAL for July 26 last (p. 152), came into force on Saturday last.

WATER ACTS FOR 1892.

IN the JOURNAL last week we gave a summary of the chief provisions of the Gas Acts of the past session. We now deal with those relating to water supply.

The Brynmawr and Abertillery Gas and Water Act contains provisions extending the water limits of the Company to include, in addition to the parish of Aberystruth, the parish of Llanbilleth, in Monmouthshire, subject to the supply being given within one year from the period of six years named in the Act for the completion of the authorized works; new water capital to the amount of £30,000 is to be raised, with the usual borrowing powers. The enlarged works will comprise an impounding reservoir situated on the Tillery Brook, in the parish of Aberystruth, with subsidiary works. Compensation water is to be delivered down the stream at the rate of 300,000 gallons daily, to be increased by 35,000 gallons per day whenever the Company shall draw from the reservoir more than 400,000 gallons of water in 24 hours. For the protection of the Lancasters Steam Coal Colleries, it is enacted that the Company may be compelled to purchase the interest in the seams of coal situate under and adjoining the reservoir embankment. The East Grinstead Gas and Water Act authorizes the raising of £40,000 of additional capital, undivided, with the usual proportion of loan. The water-works of the Company are to be enlarged by the construction of an adit in Broadstone Warren, with a reservoir and pumping station in the parish of East Grinstead, all to be completed within five years. Provision is made for the protection of Ashdown Forest. Water-mains may be laid in undedicated roads. Section 75 of the Act of 1878 is repealed; and the Company may supply water by measure either for domestic or other purposes.

The Pontypridd Water-Works Act authorizes the raising of £120,000 of additional capital, to carry the usual proportion of loan capital. The works are to be enlarged by the construction of a reservoir to impound the waters of the Rhondda Fach River, to be completed within five years. For the protection of Local Boards interested, it is enacted that certain filter-beds and a service-tank shall be completed within fifteen months, and others within four years. The service-tanks to all filter-beds authorized by the Act must contain not less than 100,000 gallons of filtered water each, and be open to inspection at all times. An existing tank is to be constantly supplied with filtered water, so that there shall always be at least one foot of water in it above the inlet supplying the town of Pontypridd. Independent mains are to be laid down for serving certain districts named. The supply is to be under constant pressure; and the Company are to carry out the authorized works in such a way as to give in the first place a storeage capacity of not less than 160 million gallons of water, to be increased, if found necessary, to 200 million gallons; and all water not supplied direct from springs must be filtered bofore entering the mains. Clauses protecting various land and mine owners are inserted in the Act. Certain collieries are permitted to tip over the water-pipes after giving notice to the Company. The Rhyl District Water Act recites the facts that the Company were incorporated in 1865, when the authorized share capital was £20,000, with the right to raise additional capital to the amount of £6000, carrying the usual borrowing powers. Further powers were conferred upon the Company by an Act of 1871, when they were authorized to raise more capital to the amount of £11,000, and to borrow £3000 in respect thereof, and also to raise, in the form of 7 per cent. preference shares or stock, the sum of £5060—being the then unissued balance of the share capital sanctioned by the Act of 1865. In 1879 the Company were again empowered to raise capital, this time to the amount of £12,000, by the issue of new 5 per cent. preference stock; and to borrow £3000. At the time of the passing of the Act, the Company's share capital amounted altogether to £48,993, all spent; and the borrowing powers had also been fully exercised, and the money expended. Besides this, in consequence of unexpected difficulties in carrying out their works, and of the increased demand for water within the district, the Company have been obliged to spend on capital account further sums to the amount of £3536 3s. 10d. out of revenue, and £4091 contributed by the Directors. The rates for domestic supplies authorized by the Act of 1865 proved insufficient; and the Assessment Committee of the St. Asaph Union having diminished the rateable values of houses at Rhyl and Pensarn, the result is, that from the year 1871 to the year 1878, both inclusive, the ordinary shareholders of the Company did not receive any dividends, and the preference shareholders received nothing between 1873 and 1878. From 1882 to 1890, moreover, the profits divided among the ordinary shareholders did not exceed 2¼ per cent. per annum. New and enlarged works being required to meet the demand for water, and the Company being unable to raise the necessary money for the purpose in the ordinary way, the consent of three-fourths of the preference shareholders and of the mortgagees was obtained to the creation of fresh pre-preference capital, which is now authorized to the extent of £25,000, of which one-half may be by borrowing on mortgage, neither preference nor mortgage interest to exceed 5 per cent. A new reservoir across the Dolwen stream is sanctioned, to be connected with the Company's existing Plas Uchat reservoir; the works to be completed within seven years. Rates for domestic supply are to range

from 7½ per cent. for houses above £40 annual value upwards, according to a scale set out for rentals, advancing by increments of £1, from £5 to £20 per annum. It is provided that, in the event of the Rhyl Improvement Commissioners being authorized, during next session of Parliament, to acquire the undertaking, the powers granted by the Act are not to be exercised. The money already advanced for the Company by the Directors, as mentioned above, is to be repaid out of the new issue of capital. The Rhymney Valley Gas and Water Act incorporates a Company with a capital of £50,000, of which £30,000 is water capital, with the usual borrowing powers, for the purpose of acquiring the undertakings of the Bargoed and Hengoed Gas and Water Companies. Additional water-works are to be made, within five years, comprising three tanks in the parish of Gelligaer and the necessary subsidiary works. The sources of supply are the waters of the springs and streams called Ysgwyddgwyn and Deri, in the parish of Gelligaer, and Llanbradach Brook, in the parish of Llanfabon. The latter water is only to be taken when the flow exceeds 150,000 gallons a day. The supply need not be constantly laid on under pressure. Rates for domestic supplies range from 10 to 6 per cent.

The London Water Act occupies a class by itself. It empowers the London County Council to promote Bills in Parliament relating to the supply of water in the Administrative County of London, and within the limits of supply of the Metropolitan Water Companies. The County Council are also authorized to institute inquiries as to the existing supply of water within the Metropolitan area, and the charges for it, and as to other sources of supply—bearing the costs thereof to the extent of £10,000.

The Airdrie and Coatbridge Water-Works Amendment Act enables the Company to raise new capital to the extent of £120,000, to carry 5 per cent. dividend, whether ordinary or preferential, with the usual borrowing powers. Additional lands are to be acquired and works constructed within ten years; the latter comprising a clear-water basin and measuring-well in the parish of Shotts, and two reservoirs, in the parish of Lamington and Wandel, to be formed by embankments across the Eastside and Cowgill Burns. Provisions are inserted for the protection of the town authorities of Lanark and others, and for regulating the compensation waters. The Company are also empowered to enter into contracts and arrangements for supplying water in bulk for domestic purposes to certain places adjacent to the authorized works. Sundry agreements are scheduled and confirmed. The Ipswich Corporation (Purchase of Water-Works) Act is, as the title implies, to authorize the acquisition of the undertaking of the Ipswich Water-Works Company by the Corporation. The agreement between the Corporation and the Company is set out in a schedule; and the consideration for the purchase is stated to be the sum of £200,000 besides the stock-in-trade, which is to be taken at a valuation. The capital of the Company is £100,000, in £10 shares, of which 1821 are fully paid, and the remainder are £5 5s. paid. In addition to the money required for the purchase of the undertaking, the Corporation want to raise £29,500 for carrying it on as a permanent work. The rates for domestic supply chargeable by the Corporation range from £5 5s. per cent. for houses of £20 annual value and upwards. Houses of gross rentals of £25 and upwards, partly occupied as shops, are to be charged at the rate of 4 per cent. only. Power is taken for creating and issuing Corporation stock. The Kilmarnock Corporation Water Act enables the Corporation to acquire the undertaking of the Kilmarnock Water Company. The agreement for the transfer is scheduled and confirmed. The consideration for the transfer is the granting by the Corporation of 10 per cent. perpetual annuities to the holders of the 1500 ordinary 10 per cent. shares and the 1000 preference 4 per cent. shares of the Company; of 6 per cent. perpetual annuities to the holders of the 1000 preference 4½ per cent. shares of the Company; the taking over of the debenture debt of £11,200, and also of the bank advance of £1173; the payment of the sum of £5000 in respect of unpaid dividends, and of a further sum of £1200. The Company retain their reserve fund of £920, and are paid for their stock-in-trade. New works are to be constructed, including a reservoir upon the streams called the Dunton Burn and Loch Burn, in the parish of Fenwick; compensating the Dunton Burn millowners with a flow of 375,000 gallons of water per day. The works are to be completed within seven years. Dwelling-houses are to be rated at their full value; but shops and places of business are not to be rated higher than 6d. in the pound. When the domestic water rate exceeds 11d. in the pound, a public rate of 1d. in the pound is to be levied on the owners of all lands and heritages, according to their full annual value. The Corporation are authorized to borrow £93,000 for the redemption of the annuities, and £30,000 for the new works and the general purposes of the undertaking. The Lanarkshire (Middle Ward District) Water Act empowers the District Committee of the Middle Ward of the county of Lanark to construct water-works and to supply water within their district. The authorized works comprise two reservoirs for impounding the stream called the Glengavel Water and some of its effluents; discharging as compensation water down the main stream a regular and continuous flow of 1½ million gallons daily. The works are to be completed within seven years. The Lanark County Council are to raise the money required by the District Committee, taking power to levy a public water-rate of not exceeding 3d. in the pound. It is provided that the District Committee shall not be obliged to furnish a supply of water to any person for less than 5s. per annum. An agreement between the Committee and the Duke of Hamilton is scheduled and sanctioned.

The Ashton-under-Lyne, Stalybridge, and Dukinfield District Water-Works Act extends the period allowed for the completion of the Greenfield and Chew reservoirs to eight and fifteen years from the passing of the Act. The supply is to be extended to Saddleworth. The Joint Committee are exempted from compulsorily supplying water-closets and baths, unless cisterns are provided for them. The Bradford Corporation Water Act enables the Corporation to construct an impounding reservoir on the River Nidd, at or near Haden Carr, and another on the same stream near Woodale, both in the parish of Kirkby Malzeard, in the West Riding, with other extension works. Saving clauses are inserted for the protection of various affected persons and corporations. The Grimwith reservoir is to be enlarged to an area of 7 acres. Certain works authorized by the Act of 1890 are to be abandoned; the Corporation paying compensation for disturbance or injury to property. The mains, &c., of the Liversedge Local Board are to be acquired by the Corporation, who are to undertake the supply of water to the district. The sum of £100,000 is to be raised for the purposes of the Act. The Birmingham Corporation Water Act enables the Corporation to borrow £6,600,000 for the purchase of land and the execution of works incidental to the bringing of the Elan and Claerwen waters into the city. The lands are to be acquired within seven years, and the works completed within ten years. Fifty works are catalogued as authorized extensions of the water-works undertaking of the Corporation. Regulations for the compensation water are duly provided; and the legal machinery for dealing with affected interests is set out. The Blackburn Corporation Act extends the water limits to include the townships of Wilpshire, Ramsgreave, Mellor, Pleasington, and Billington, all in Lancashire. The Swansea Corporation Water Act authorizes the construction of additional works, including a reservoir to be formed by a dam upon the River Cray. If by tunnelling for water the Corporation affect springs within 600 yards on either side, they must compensate the injured parties. The works are to be completed within ten years. Compensation water to the extent of 1½ million gallons per day is to be discharged down the Cray. Neighbouring local authorities are to be supplied with water in bulk at a charge calculated at 4½ per cent. upon the capital cost of the necessary works. The present district of supply has a prior right to 25 gallons per head of the population daily. The Corporation are empowered to borrow £270,000 for the purposes of the Act, by the issue of Corporation stock. The Tredegar Water-Works Act is to authorize the Local Board to enlarge their water-works by the construction of a pipe-line from a certain spring known as Shon Sheffry's Well; not taking more than 600,000 gallons of water daily from this source. The works are to be complete within seven years. The Local Board desire to borrow £35,200 for the purposes of the Act. The Uttoxeter Water Act enables the Uttoxeter Rural Sanitary Authority to provide an improved water supply to certain places in their district; taking over some existing works which are maintained by an ancient charity, together with the funds. The water is to be drawn from the Bramshall and Somershall Herbert Springs. The sum of £10,000 is to be borrowed for the purposes of the Act.

ARITHMETICAL CHEMISTRY.*

Some reference to Mr. C. J. Woodward's text-books has already appeared in the Journal; and much that has been said with regard to Part I. under the above title, and "A B C Five-Figure Logarithms," applies with equal force to the work now before us, which occupies the position of an extended course to the first part. It is specially worthy of recommendation to the notice of gas engineers, as comprising, in a small compass, a great deal of information which everyone needs to have at his fingers' ends, but which nevertheless is just the sort of knowledge that he is liable to forget. The object of the author may be illustrated by the following quotation from the preface: "Gerhardt asked why certain acids should be considered monobasic, while others were regarded as bibasic, to which Laurent satirically replied: "An acid is monobasic or bibasic according to the repute of the chemist who considers it such. The student commonly adopts without thought certain atomic weights and formulæ, because they are used in the chemistry books with which he is familiar; but, in the following pages, I have endeavoured to show that the repute of the author has nothing to do with the matter, but that certain simple principles, which the student himself can easily apply, will justify the formula and atomic weights which he is in the habit of using. Better to press this point, many of the exercises refer to imaginary substances to which the student can apply the principles of chemical philosophy, without the bias of custom to

*C. J. Woodward's Educational Works. Book B, or "Arithmetical Chemistry." Part II. By C. J. Woodward, B. Sc., Principal of the Chemistry and Physics Department of the Municipal Technical School, Birmingham. New edition. London: Simpkin, Marshall, and Co.; 1892.

guide him to his selection." In addition to the preface, there are a few preliminary remarks on arithmetical operations, and the most advantageous modes of shortening them, in the course of which the benefit derived from using the author's tables of logarithms (a copy of which is presented with the book) are pointed out. The use of numerical exercises and illustrations, when teaching the laws of chemical or physical science, is strongly advocated—not that there is any vir tue in the mere arithmetic, but because they afford a means of making the proof or the application of those laws perfectly clear to the mind of the student.

Following the plan that was adopted in the previous works, the subject is divided into lessons; each lesson comprising the instructive part, several examples, and lastly a number of exercises, the answers to which are given at the end of the book. By this means the student is placed in a position to prove his own knowledge. While necessarily treating upon many points of chemical theory, the author has, with but few exceptions, confined his attention to those matters which have advanced beyond the range of debate, and are generally accepted as axioms. There are eighteen lessons in all. Among those that are especially worthy of particularizing here are No. 3, which deals with Dalton's law of partial pressures, correction of a given volume of moist gas, and other calculations preliminary to exercises on gas analysis; No. 4, describing Bunsen's, Hempel's, and other systems of gas analysis, and the calculation of results from the experimental data; Nos. 6 and 7, which treat of Avogadro's law, and the determination of molecular weight by vapour density; Nos. 10, 11, and 12, devoted to atomic weights; No. 15, on dissociation and the temperature of flame; and Nos. 17 and 18, comprising the diffusion and absorption of gases. From these the gas engineering student who desires to improve his knowledge on the chemical or philosophical part of his profession may select many interesting examples, to be worked out by himself with pleasure and profit, and made the means of affording at least as good general knowledge on the subject as he can gain by desultory reading, or even by a careful perusal of the ponderous tomes which mystify rather than explain the mathematics of chemical science. And the older and more experienced manager of gas-works, who used to be "very well up in these things," need not disdain to use these "lessons" as a means of checking results, or as a work of reference. We hope Mr. Woodward's endeavours to put this important subject before the reader or the student in a concise and easily understandable form are meeting with the degree of support which they undoubtedly deserve.

Alderman Avery has thought fit, owing to his advanced age and failing health, to resign the seat he has held in the Birmingham City Council for the past 30 years. Some of our readers may remember that he took a prominent part in the negotiations for the acquisition of the water-works; and his name has since frequently appeared in our columns as Chairman of the Water Committee.

The Inquiry Circular Nuisance Again.—Our attention has been called to a circular, emanating from the Clerk to the Nuneaton Local Board of Health, requesting an opinion as to the desirability, from a ratepayers' point of view, of a gas undertaking belonging to a local authority, and as to the possibility of gas being superseded by the electric light, and therefore making the purchase of such an undertaking unadvisable. As the Board are considering the question of purchasing the gas-works in their town, they are anxious to have any other information that will help them to come to a correct decision thereon. One gas manager has received no less than three circulars of this kind in the course of a month; and we presume he promptly put them into his waste-paper basket. Another, writing to us upon the subject, remarks that it looks like an attempt to "get information on the cheap." He has declined to express any opinion whatever; and he has referred the author of the circular to two or three well-known gas engineers who make it their business to advise on such matters, as he does not, he says, believe in "depriving anyone of his legitimate source of income."

The Royal Commission on the Metropolitan Water Supply.—The sittings of the Royal Commission on the Metropolitan Water Supply will be resumed, under the presidency of Lord Balfour of Burleigh, to-morrow, and will be continued on the two following days. On these occasions the engineering evidence offered by the London County Council, by the associated Metropolitan Water Companies, the Thames Conservancy, and the Hertfordshire County Council will be taken. The witnesses will be as follows: For the Water Companies, Mr. T. Hawksley, Sir F. Bramwell, Mr. Peregrine Birch, Mr. Baldwin Latham, and Professor H. Robinson; for the Thames Conservancy, Mr. H. J. Marten and Mr. H. Rofe; for the London County Council, Mr. A. R. Binnie and Mr. Easton; and for the Hertfordshire County Council, Mr. J. Hopkinson and Mr. A. Smith. An adjournment will then be made till the 19th, 20th, and 21st inst., when the Commissioners will have geological evidence from the following witnesses: Dr. H. Woodward, Mr. R. Etheridge, Professor Boyd-Dawkins, Professor A. H. Green, Mr. Whitaker, Mr. Topley, Mr. H. B. Woodward, Sir J. Evans, and Mr. Docwra; and Mr. T. E. Young (Actuary) will give evidence on behalf of the London County Council.

NOTES.

Gulcher's Gas Thermopile.

An interesting, if not a very profitable application, of gas is in a thermopile producing electricity from the heat of combustion. Gülcher has been working in this direction for some time past, and has now designed an apparatus which gives improved results. The arrangement consists of rows of copper sulphide plates, mutually insulated with asbestos paper, and heated by a nickel atmospheric burner. It is made in three sizes by Julius Pintsch, of Berlin. The smallest pattern has 26 elements; and when burning gas at ordinary pressures, yields a current of 1·5 volts. The second size is double the power, giving 3 volts; and the largest gives 4·4 volts. The internal resistance of the cells is 0·25, 0·50, and 0·65 ohm respectively; so that a current of 3 ampères can be obtained. The rate of gas consumption in the three sizes of apparatus is from 70, 130, and 170 litres per hour. The total electrical energy of the new cells is about 70 volt-ampères per cubic metre of gas consumed per minute—which is three times the duty obtainable from older patterns of the apparatus. The first size is useful for the purposes of lecture demonstrations, &c.; the second will do electrolytic work for laboratories; while the third is powerful enough to charge accumulators, do telegraphic work, &c.

Another Selenium Photometer.

Mr. S. F. Van Choate, of Boston, has designed a photometer upon an electrical system, which is described and illustrated in a recent number of the *Scientific American*. It is intended to render photometrical work more exact, by eliminating the personal equation; but whether it does not introduce other equally objectionable sources of error, is a question that suggests itself immediately it is seen that selenium is employed as the controlling agent. Mr. Van Choate employs a selenium cell to receive the beam of light. The instrument is of the nature of a balance connected with a differential galvanometer; the standard light being directed to one side of the balance, and the light to be tested being on the opposite side. The two lights are fixed at the opposite ends of a tube, in which are contained two adjustable selenium cells, capable of being moved along the tube, just as the disc-holder is in an ordinary Letheby photometer. The sensitive cells are connected in circuit with a rheostat, a differential galvanometer, and a battery. The idea is that, if the two lights are equal, they will affect their selenium cells equally, and these will stand at the same distance from the lights; and the galvanometer will show the existence of balance. If, however, one light is inferior to the other, its selenium cell must be moved nearer to it, until the galvanometer again indicates equilibrium. The extent of the movement necessary, of course, serves as a basis for calculating the comparative illuminating power.

The Dissociation of Hydrocarbon Gases by the Electric Spark.

Dr. C. Ludeking recently communicated to the *Philosophical Magazine* some results of a number of experiments made during the past year on the action of the electric discharge, as furnished by a Ruhmkorff coil, on different kinds of gases and vapours of various substances; the object being to ascertain whether electrolysis takes place. The general conclusion, deduced from a qualitative difference in the products of decomposition that collect at the poles of the apparatus, is in the affirmative. Among other substances, Dr. Ludeking made many experiments with marsh gas, olefiant gas, and coal gas. A remarkable fact was observed, which speaks strongly in favour of actual electrolysis, in the case of the gaseous hydrocarbons. It is, that the deposit of carbon for these latter always grew out from the positive pole, in a way that would indicate its having been separated out at that pole and not mechanically projected against it. The experiment is most conveniently made with coal gas; and the sparking done in a cylinder over mercury. The carbon grows from the positive pole in the form of a very fine filament, very hard and very brittle, and possessing most excellent conducting power. The film is very thin—indeed, thinner than a horse-hair. On examining it under the microscope, it is found to be toothed in a very regular way, the teeth being sharp cones projecting towards the negative pole. It appears to be the product of a true electrolytic separation. From the slenderness and the form of the deposit, Dr. Ludeking does not believe it can be deposited by projection. Some dust of carbon is so deposited on the negative pole, but only in small amount. Consequently, the action of the discharge upon coal gas is not simple, but is of complex character. There was no appreciable difference between the hydrocarbon gases examined, except that the deposition of carbon takes place most rapidly from the richest gases. The volumes of the gases increase rapidly on sparking. The increment in volume, when marsh gas and olefiant gas are subjected to the electric discharge, is so striking that it can be shown to a large audience. Filaments of carbon 6 to 8 mm. long can be readily obtained in a few minutes; and in continuing the discharge, they finally connect the two poles, when the spark ceases. When the electric discharge acts upon the vapour of carbon disulphide, the volume diminishes rapidly; no electrolysis takes place; and the vapour is an almost perfect non-conductor.

TECHNICAL RECORD.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

The Thirtieth Half-Yearly Meeting of this Association was held on Saturday last, at Seaham Harbour. Considering the out-of-the-way place it is—a special train being required to convey those attending the meeting for the last seven miles of the journey—there was a large turn-out of members. On leaving the special train, which had brought them to the gates of the gas-works, the party were shown over the place, and afterwards partook of luncheon in the office of the Manager (Mr. J. Whyte, the President for the year).

The Seaham Harbour Gas Company was originated in 1873; and its works were erected in the following year, to designs by Mr. W. Ford, of Stockton. They are very conveniently situated on high ground upon the seashore, and are served by the Seaham and Sunderland Railway, which is the property of the Lord of the Manor, the Marquis of Londonderry. The site of the works is an ample one; and the works themselves are very efficiently arranged—the buildings forming three sides of a square, and the gasholders occupying the fourth. A high-level railway brings the coal direct into the retort-house; and a steam-hoist enables the coke to be taken away without difficulty. The retort-bench is a single one, with ten ovens, half of which contain beds of ⏢-shaped retorts, 15 in. by 18 in. by 9 ft., in settings of fives and sixes, fired on the old principle. The other half of the settings are constructed on Frith's generative system; the retorts, which are set in sixes, being 15 in. by 20 in. by 9 ft. The condensers are horizontal; and the scrubbers of the tower description. The purifiers are four in number, 10 feet square; and Mr. Whyte uses both lime and oxide in them, though he does not look with much favour upon the latter. The exhauster is a Beale, by Messrs. Gwynne and Co., of London; and the station meter (which is of 10,000 cubic feet capacity per hour) and the governor are by Messrs. W. and B. Cowan, of Edinburgh. There are two gasholders, one of 110,000 feet, and the other of 100,000 feet capacity. The works are of an ordinary description; but they are in good order, and quite equal to the output, which is about 23 million cubic feet per annum. There is some difficulty in disposing of the coke, on account of the population being a mining one, most of whom get coal as part of their wages. A tablet above the retort-house door gives the interesting information that Mr. J. B. Eminson, the Marquis of Londonderry's agent in the district, has been Chairman, Mr. Ford the Engineer, Mr. Whyte the Manager, and Mr. H. B. Wright the Secretary of the Company, since its formation.

The party were next conveyed by brakes to Seaham Hall—the local seat of the Marquis of Londonderry—which is pleasantly situated on the banks of a wooded dell about a mile to the north of the town. On alighting, they were first shown, at the Rectory door, the parish register of 1815, containing the signature of Lord Byron, whose unhappy marriage to Miss Millbank was celebrated in the Hall close by. A stroll through the grounds was exceedingly enjoyable; but it consumed more time than could well be spared, and consequently the business part of the meeting was delayed so long that there was not time to fully discuss one of the subjects on the *agenda*.

The Meeting was held in the Board-Room of the Gas Company, at their offices in Tempest Place—Mr. WHYTE presiding.

WELCOME BY THE CHAIRMAN OF THE COMPANY.

Mr. EMINSON, having been introduced to the members by the President, said it was certainly very gratifying to the Directors of the Seaham Harbour Gas Company to see them there. Gas managers were gentlemen for whom those in his position had very great respect. They did not often own many masters; but they were obliged to own gas managers, to a certain extent, as masters. It was a great pleasure to him and his co-Directors to feel that they had been honoured, on the first occasion on which the Association had come out of the greater districts, by the selection of Seaham Harbour as the meeting-place. They had, in Mr. Whyte, an excellent Manager, and a gentleman for whom they had considerable respect and esteem; and it had given them much pleasure to learn that it was through the kindness of the members, in selecting him to be their President, that the meeting was being held there that day.

The PRESIDENT said he had much pleasure, in the name of the Association, in conveying their thanks to Mr. Eminson for so heartily welcoming them. He hoped that the members had all enjoyed themselves up to that point; and that when the day was done they would all feel it had not been badly spent.

The PRESIDENT then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—It is with very conflicting emotions that I appear before you to-day—feelings of deepest gratitude to you for the high honour you thought fit to confer upon me in electing me as your President, a position certainly unsought, and to my mind misplaced. No one can realize more the responsibility of such an appointment, with the honour of such an Association at stake. It was only my deep sense of loyalty as a member, and the assurance of your kind forbearance and co-operation with me (for I feel sure every one of you will bear with my shortcomings, and accept of the will to maintain the usefulness of this Association), that would ever have induced me to accept such a trust at your hands. For the honour you have done me, I now return you my very sincere thanks.

I will not attempt to lead like the great men of the past who have preceded me, and so ably filled this chair; but will simply content myself with making a few remarks on some commonplace objects we meet with in the daily round of duty. I feel all the more honoured to fill such a position in this centennial year of the history of gas lighting, when some of us were permitted to witness the erection of a monument to perpetuate the memory of that quiet, unpretentious Scotsman whose name will be handed down so long as history continues to be written, and who, undreamt of by himself, did so much (and that without any fee or reward in the shape of royalties) for the comfort and convenience of his own day and generation, as well as of those who were to follow him. Little could William Murdoch imagine the great and important part that his grand discoveries of the locomotive in 1784, and then of his use of gas in 1792, were destined to perform in the future for the civilization of the world, and the hastening on of that happy time we look for—

> "When man to man, the warld o'er,
> Shall brothers be for a' that."

We cannot but respect the man who, by his own unaided effort and persevering determination, raises himself from humble origin to a position of highest affluence in life; and does not the somewhat tardy honour done to this hero of civilization strike us as all the more deserved, when we think of the poems that have been sung, the books that have been written, and the monuments that have been erected to men who invented means of destruction instead of for comfort and progress? Millions have been benefited by Murdoch's inventions; and we ourselves are much indebted to his inventive mind for the many comforts we possess from lighting, heating, power, &c., as well as the gorgeous colours we so much admire, seen daily in the beautiful dress material now so familiar to us, and which add so much to the pleasures of life, especially among the fairer sex. And let us each one, but more especially the young, take courage from his example, determine with God's help to overcome the difficulties with which we are surrounded, and thus seek to make the world brighter and better than we found it. Though we cannot all be William Murdochs, yet we have each a niche in life to fill. Therefore let us be up and doing what little we can to prove that, notwithstanding all the cry that has been raised, the calumny heaped upon it, and the various efforts put forth to throw our industry into the shade, gas is able to hold its own.

We do not shut our eyes to the great advance made by our mutual friend "the light of the future." It certainly has been the light of the future for the past fourscore years; and, so far as present appearances go, may be for fourscore years to come, when we will all have gone to rest. We have no wish to discredit the electric light in any shape or form, but simply ask for "a fair field and no favour;" knowing that Time—the great healer of all sores, and the leveller-up of inequalities—will prove which is the fitter, and will assign to both gas and electricity the different spheres they are destined to fill in the march of progress. For my own part, I consider oil a far more formidable competitor (if competitor it can be called). Why oil has such a hold as an illuminant, I cannot tell; as it cannot be the price, taking light for light, as compared with gas, nor can it be its convenience, or its greater safety. Scarcely a week passes without the newspapers bearing sad testimony to the danger of the use of these oil-lamps in domestic life, more especially in the case of women and children. Nor can it be, as many fallaciously imagine, its greater advantage from a hygienic point of view, the latter of which is urged, and with considerable truth too, in favour of the electric light. But be the cause what it may, the fact remains; and we must do our best to show the advantages of gas, and remove the prejudice that, I fear, has so much to do with it.

To my mind, it is pretty clearly proved we are not on the right track with our present mode of collecting gas accounts. While it suits a certain class who can always fill up a blank cheque for the gas consumed, or even put their hand into their pocket when the collector calls, what of the tens of thousands of working men whose better halves find that money will not keep for months, especially at a time when rates, taxes, rent, and the other expenses with which unfortunately householders are often too familiar, come alongside of the gas account? I am afraid we must look to the automatic system of collection, which we can almost say is perfect now, or arrange for the collectors to call oftener, if we expect to make much headway against oil.

In the admirable paper read by our late friend Mr. J. H. Cox, at our October meeting in 1889, he showed, in a most conclusive manner, from the figures he so carefully compiled, that price has very little to do with the consumption of gas. This will be seen from his table, showing one town supplying gas equal to 145 candles per hour per penny, and only 10 per cent. of the population using gas, while another town, supplying only 122 candles per hour per penny, gave 23 per cent. using gas. So that, while granting price has something to do with it, we must look somewhere else for the real solution of the matter. Much has been done by many manufacturers, who have toiled "from early morn to dewy eve" to improve the means of con-

suming gas, and for its general utilization. All honour to them for the great advancement they have made; but, even now, we have not reached the "rest and be thankful" stage. We must keep our minds open to accept every improvement in the manufacture of gas, and avail ourselves of every means to cheapen its production, and then see the most is made of it, so that the consumer will receive the greatest value for his £ *s. d.*

During the past year or two, several important changes have taken place in the mode of carbonizing coal; not the least of them being the inclined retort system, which, through the kindness of our worthy Vice-President, I have had the pleasure of seeing, as he has four settings of sixes 20 ft., by 24 in. by 15 in. or 48 mouthpieces, at work in Middlesbrough, heated with regenerative furnaces of his own designing, and which give promise of outdoing anything of the kind I have yet seen or heard of. The working of these retorts is simplicity itself, as all that was done was to open the door at the bottom end, withdraw the stopper, "tickle" the coke, and, the top door being opened, simply push the remaining coke with a bar, when it shot out at the lower end. The stoppers being again placed in position, the bottom door was closed, and the coal (7½ cwt.) run in; the whole process occupying from 3 to 3½ minutes, and reducing the carbonizing expenses to one-half at present. But, being as yet only in the initial stage, there can be no difficulty in reducing the expense to at most one-third of that under the old method. The heat generated from breeze and material formerly carted away seems under perfect control; and the whole arrangements appear so admirably suited to do their work, and make the manager less dependent on stokers, that I venture to predict a great future for the system, which, I ought to say, is to be further extended in the same retort-house at Middlesbrough—a very practical proof that the system is found satisfactory. But on this matter we may expect to hear more from our friend Mr. Terrace, after he has had further experience with them.

Most, if not all, of us have, during the past few months, passed through a trying ordeal, owing to the unfortunate struggle between capital and labour in the miners' strike, or lock-out, whichever we may call it—a dispute which, unfortunately, did not confine its effects to the county of Durham, bad enough though that was, but was felt by tens of thousands far beyond the county, and which, like every other strike, brought misery, beggary, and suffering almost beyond description on many a happy home, where peace and contentment had existed. This, I think, shows the pressing need of some means being adopted to prevent such a struggle, which will assign to both capital and labour each its proper share, and when labour shall feel that even a few paid demagogues cannot change natural law, and separate the interests of employed and employer, which are one and the same. While we freely admit the right of every man to sell his labour (which is his capital) to the very best advantage, yet we cannot, and will not, admit the right, or rather the might, of Union to compel any man to surrender his will, and perforce deprive him and his of an honest livelihood, and, instead of the bread of honest industry, compel them to accept an alms doled out by the parish officer, or, it may be, by some kindlier hand, while he himself was happy and contented in the assurance of steady employment, and enjoying a comfortable living, and at the same time the full confidence of his employer. We assuredly cannot but sincerely deplore such a state of things; nor can we shut our eyes to the fact that capital and labour are drawing nearer a crisis. In what department or on what platform it may be fought we know not; but the sooner poor infatuated working men begin to think for themselves, and, realizing their individual responsibilities, dare to act for themselves, instead of falling down and worshipping the golden "Juggernaut" of Union, so much the better will it be for all classes of society, but especially for themselves.

For some time now the high price of coal and labour, combined with the very small returns for our residuals, have told in a most serious manner upon the revenues of gas companies. We have evidently got past the best of these residuals, as sulphate of ammonia has now reached a price that would have hardly been thought possible a few years since; and, though we still hope for some improvement in the price of that article, we can hardly hope for more than one-half what it then was. As for tar, that seems even in a worse condition, as at present it is such a drug in the market. I have very serious doubts, if we are making the best of it by selling it at such absurd, prices. Why it should be of so little value is rather surprising, when we consider the almost innumerable products it contains, and the manifold purposes to which they can be applied. At the time of the recent strike, to which I have already referred, in order to economize as much as practicable the stock of coal I had provided, and, if possible, avoid going to market to pay specially high prices, we commenced to carbonize our tar in a way that most would consider perhaps rough and ready—that is, by simply pouring the tar over the coals just before charging them. The result was that I saved from 20 to 22½ per cent. of coal, and so was able to tide over the strike, and for nearly three weeks beyond it. We used in all somewhere between 5000 and 6000 gallons of tar during the time we were on with it. The question will naturally resolve itself into, "Did it pay you?" My answer is, "Yes; or else we should not have done it." It was certainly rather dirty, disagreeable kind of work; but, in justice to the men, I must say they took kindly to it, and really tried to make the best of it. Affected as we were with the reduced make of gas, through the strike, and the retorts lying a good deal idle, I was not then in a position to say what the net result was; but I felt so pleased with the return we got, that I determined to test the matter still further. This I have since done, but not using so much tar, and with the following results: To the coal we have been using, regularly producing (say) 10,000 cubic feet of gas per ton, we added 10 gallons of tar per ton, just poured over the coal, which produced 11,900 cubic feet of gas per ton, being an increase of 1900 feet, and an increase from 16½ to 17½ candle power. This clearly proves, to my mind at least, that, without any fine, elaborate patent process, much can be done to reduce the quantity of tar put upon the market. I am fully aware of the difficulty of adopting such a process in large gas-works, though even there I think some means could be devised to use part of it, at all events; and thus, by a reduced output, we may reasonably expect a better price for what there is to sell. But, in many small works, there need be no difficulty in thus using most of the tar. I am not in a position to say what quantity of tar we produced per ton during the experiment; all that I wanted was the quality and quantity of the gas made per ton of tar, as compared with the ordinary working.

Regarding the outlook for the future, it seems we are again past the worst, so far as the raw material—coal—is concerned, as there is a decided fall in the price; and, small even though it is, it will certainly help. We can only hope that the labour market will likewise very speedily settle down, so that confidence may be restored to the capitalist, and peace and prosperity take the place of the restless spirit which is doing so much to drive trade and commerce from our island home.

Again thanking you for your kindness in electing me to this position, and craving your kind forbearance and help during my tenure of office, I can assure you that no effort will be wanting on my part to hand over the honour of this Association as unsullied as I found it.

Notes on Asphalte Paving.

Mr. H. Tobey (Malton) then read a paper bearing the above title. This appears to-day in another column; and a report of the discussion which ensued will be published next week. At its close, a hearty vote of thanks was accorded to the author.

Tar as Fuel.

Mr. T. Bower (West Hartlepool) next read a short communication he had prepared on the above subject; and this also appears elsewhere. Time did not permit of the matter being discussed; but a vote of thanks was passed to Mr. Bower for the trouble he had taken in introducing the question.

New Member.

Mr. W. D. Gibb, Assistant-Manager of the Gateshead Gas-Works, was admitted a member.

Votes of Thanks.

Mr. Bower proposed a vote of thanks to the President for his address. Mr. Whyte, he said, was a practical man; and he had not departed from his practical ways in his address. As he passed up the centre walk to the gas-works that morning, he could not help thinking of the murmurs he had heard, not only in the town he came from, but in other towns, of gas-works being a nuisance. He confessed that in West Hartlepool he could not point to such a fine grass plot as existed at the Seaham Harbour Gas-Works; and this proved to him that such works could be kept in better order than they usually had credit for.

The motion having been carried,

The President returned thanks, and stated that, if the meeting had been interesting and profitable, he felt amply rewarded for what he had done.

Mr. W. Ford (Stockton) then moved a vote of thanks to the Chairman and Directors of the Seaham Harbour Gas Company, for their kindness and courtesy in permitting the members to assemble in such a pleasant way. He regretted that some of their older brethren were not with them, because he believed that, in this new departure in going into the country, they would have had a foretaste of what they might expect in future years. If they did not go into the country, they could not expect the country members to come to their meetings.

Mr. D. Terrace (Middlesbrough) seconded the motion, which was also adopted.

Mr. H. B. Wright, the Secretary of the Company, returned thanks; remarking that they were pleased to see the members at Seaham Harbour, and also to have Mr. Whyte presiding over the meeting.

This concluded the business on the *agenda*.

The members afterwards dined together in the Railway Station Hotel, under the presidency of Mr. Whyte; and the usual toasts were duly honoured.

The Notification of the Metropolitan Gas Referees for the coming winter, which was issued last week, contained the intimation usual at this season, that the maximum amount of sulphur allowable in London gas will, until further notice, be 22 grains per 100 cubic feet.

NOTES ON ASPHALTE PAVING.

A Paper read by Mr. H. Tobey, of Malton, at the Meeting of the North of England Gas Managers' Association last Saturday.

It is not my intention to make any research into the history of road making with coal tar as a cement to bind the materials together. The discovery of its usefulness in that direction was probably somewhat after the manner of the discovery of the lusciousness of roast pig, which Charles Lamb has related with such delightful literary skill. The original "gas man," and those passing in and about the gas-works, must very early have noticed the binding and waterproofing effect produced upon the ground where any tar had been spilt. The first efforts to produce a tar pavement would probably be in the direction of spilling more tar over other portions of the road proposed to be improved. This way—like the burning down of houses to produce roast pig—was soon found to be extravagant and unscientific. Successive coatings of tar, and layers of sand or ashes, would no doubt produce a tough, elastic, and waterproof pavement of a very durable nature; but it would be tedious to make, and consume much time and material. The shorter and more convenient method is to prepare the materials, lay them in their intended position, and roll them down.

In the process of gas manufacture, a large amount of *débris* is produced, which often gives trouble in removal, and is difficult to get rid of. Sometimes it is given away; at others, it is necessary to pay for its removal. I refer to the ash-pan refuse, the clinkers, and the old retorts and fire-bricks. To it may be added the small refuse from the coke stack. These form materials admirably adapted for asphalte or tar paving. Should the coal in use be such as contains a large percentage of ash and clinker, it is astonishing the accumulation of refuse of this kind which takes place. In utilizing these materials for asphalting, such of them as are not already small enough in size must be reduced. I find it convenient to pass them through a crusher, consisting of an old bone-mill, which breaks them down so that the largest pieces are less in size than walnuts. It is then sorted into sizes by screening; the larger or coarser portion being put aside for the bottom or foundation course, and that portion which will not pass through a ¼-inch screen is reserved for the top or finishing course. In this manner, the refuse heap is entirely kept down, and the only useless things requiring to be removed from the works are simply mud and dirt which contains no grit in it. The old retorts and fire-bricks, or rather brick-bats, and the clinkers give hardness and durability to the material. If too much breeze exists in it, it is soft and easily crushed when traffic comes upon it. The finer particles of the ashes and clinkers which have come from the breaker, when tarred, form a mortar or cement which gets into the interstices of the larger pieces of material and unites them together. For ordinary footpaths and back yards and court yards, these materials, with the addition of some hard gravel or spar on the surface, are sufficient for all practical purposes. It is not suggested that cart roads can be made in this way, or that it will stand hammering or pounding on. For such hard work, stronger and harder materials are required; and they should be laid thicker than for ordinary footpaths.

The next part of the work is that of mixing and coating the materials with tar, and partly saturating them with it. This requires some care and judgment, as too little tar or too much produces unsatisfactory results. In the one case, the pavement very soon breaks up and kicks to pieces; in the other, it gets soft and runs, and in hot weather the tar works out on the surface and treads about. Makers of asphalte differ much in their mode of procedure. Some heat their tar, and others the solid materials; the object either way being to drive off the small quantity of ammoniacal liquor which is always held in suspension in the tar, and also some of the lighter oils; and furthermore to give such fluidity to the tar as will make it run freely and mix with, and be absorbed by, the materials to be tarred. There is some little advantage in heating the tar if it is done in closed vessels, as the vapours can then be condensed by passing them through a condensing worm or still, and the ammoniacal liquor and light oils can be collected. If the tar is thin, it is the more expedient to treat it in this way; the light oils being a saleable product. If we proceed by the directions given in "Newbigging's Handbook," we shall heat both the tar and the materials. I do not, however, regard it as necessary to do both. There is no doubt the solid materials work better when dry; and care should be taken to keep them dry. There is always a quantity of small coke in ash-pan clearings; and, when heaped up, if a little fire be put in, it readily burns through the heap, and drives off all moisture.

Though dryness of the material is, in my opinion, desirable, it is not absolutely necessary. I have known very good asphalting to be made with materials which were decidedly damp—I might say, wet; the only difference between it and other asphalting being that it did not set quickly. In a paper read before the North of Ireland Association of Gas Managers, in 1888, by Mr. Featherstone, of Dundalk, it is laid down as a rule that the materials—cinders, stone riddlings, and gravel—should be first drenched with water, and regularly puddled; then the tar added, and thoroughly mixed into a slush, with the caution to heat neither "stuff" or tar, and a final direction to add more water when laying it down. This method of proceeding is, you will see, entirely contrary to the generally received ideas of the way to make tar or asphalte pavement. I have not found it answer to prepare it in this way. How the tar can be made to adhere to the wet materials is not at all evident.

As to the quantity of tar to be used, no exact and unvarying rule can be given. The nature of the materials, and their fineness or coarseness, will make considerable difference. Materials such as breeze, oolitic limestone, chalk, &c., have a great absorbing power. The oolitic limestone gravel that is obtained in our neighbourhood is quite unsuited for asphalting, on account of its absorbent properties. After treatment with tar, it soon becomes dry; the only apparent result of the application of the tar being that the gravel has put on a suit of mourning. On the other hand, hard, dense stone or gravel, such as whinstone, requires very little tar to cover and saturate it. With respect to the fineness or state of division, it will readily be conceived that the sum of the surfaces of any given quantity of material will be considerably larger when it is broken up into very small particles than when the particles are large in size. For instance, a cubic yard of solid rock will have less superficial area than when it is broken down into sand. Consequently, the fineness of a material increases the surface to be covered with tar.

I find in practice that it takes about 40 gallons of tar to make a ton of the foundation asphalte prepared from the materials I have mentioned—viz., clinkers ash-pan refuse, and old fire-brick refuse ground up together—and about 50 gallons of tar to make up a ton of the fine or top material. It is always desirable to have in the top material some hard stone or gravel, as it is upon the upper surface that the wear takes place.

In every locality, there is nearly always to be found some native rock, igneous or otherwise, which is suitable for the work; or artificial substances, such as the slag from ironworks, may be used if broken to a suitable size. The fine asphalte prepared for the finishing course, when laid on the rougher material forming the foundation, falls into the interstices of it, and, in addition, makes a thin superficial top coat; and, if durable, hard-wearing material is incorporated with it, the life of the pavement is very much prolonged. Where pavement is to be subject to extraordinarily hard wear, it should be made entirely of such durable materials; but my main object has been to turn to account, and use up, the materials at hand which I found an encumbrance.

Having prepared the materials, the next labour is to place them in position. It is desirable to have a firm foundation to lay them on; but the nature of the foundation, and the amount of it, depends largely upon the purpose for which the asphalte-paving is intended to be used. Where it is proposed to asphalte existing footpaths, which have been trodden down and made firm by past usage, and which are not intended to have heavier work upon them than the ordinary wheelbarrow, the materials may be placed directly on them without the formation of a foundation. I have known a tennis-court laid with asphalte upon ground from which the turf only was removed, and on which the thickness of the asphalte was not more than 1¼ inches; and it stood remarkably well. It is often specified that asphalte shall be 3 inches thick; but this appears to me an unnecessary thickness. The asphalte on nearly all the yards and paths we lay does not exceed 2 inches in thickness. First the rougher material is laid down, levelled, and rolled; then the fine is put on, and a little gravel or some Derbyshire spar sprinkled over it; and this also well rolled. The fine gravel or spar assists the rolling, and prevents the material clinging to the roller. Care has to be taken to get a proper watershed so that the wet may run off to the gullies, and not remain to make puddles for unwary feet to splash into. Of the bottom or coarse material, it takes from 50 to 55 cwt. to cover 100 square yards; of the fine, about 30 cwt. for the same area; and of spar or fine gravel, about 4 cwt.

My experience is that the manufacture and laying down of asphalte paving by the Gas Company has been appreciated by the public; and there is a fairly constant demand for it through the summer months, beginning about March and going on to the early part of November. We would not wish the demand to be continued beyond that time, as, in the winter months, we do not want to be troubled with it. The price charged is 1s. per square yard within a radius of 2 miles of the works; and beyond that distance, an extra charge is made for cartage. The price does not include any levelling of ground or foundation work. The average sales during the past eight years have been £205 per annum; and the profit thereon, after paying for the tar, labour in preparation of materials and outlay for gravel, spar, &c., has been over 40 per cent. As a minor branch of the works, it possesses the advantages of disposing of about 20 per cent. of the tar we produce, of keeping the men in our employ together in place of putting them off in the summer season, and, as I said before, it meets a want among our customers.

This asphalte paving has points in its favour, of which the following are some: In the first place it is cheap; no other pavement is so cheap, be it bricks, concrete, or flags. It makes a firm, hard pavement, free from moss, weeds, and mud. It is especially a dry pavement—brick and flag pavements allow the damp to penetrate through from below, but that is not the case with asphalte pavement. If placed under cover, it is permanently dry; it is therefore admirably suited for ground floors, on which articles are stored which have to be kept dry. It is obnoxious to vermin—such as rats and mice; they avoid it,

and will not make holes or runs in it. And, furthermore, it is antiseptic and deodorant. Noxious and offensive gases will not pass from the soil through it. The sanitary condition of yards, the soil of which has become impregnated with garbage and filthy soakage, is vastly improved by the adoption of this pavement. It is a great advance in tidiness and cleanliness, and consequently of godliness. It is easy to repair, and to make good if disturbed, and is durable and lasting if not neglected. It is most desirable and expedient that every other year it should be tarred over with a brush and sprinkled with sand, spar, or grit of some kind. Such a course of treatment has the same effect as the application of Madame Rachel's wonderful cosmetics to the face of the human species—it beautifies its appearance, renews its youth, and lengthens its life.

Now that village councils are to be the order of the day, and the problem of how to retain our labouring population in the villages and prevent their exodus to the towns has to be solved, how can the parish parliament do better than commence to mend their ways, and make the paths of rural life more smooth, pleasant, and attractive, and what cheaper and better method can they find to do that than by laying down asphalte footpaths. When they commence this much-needed work, I think they will find most gas managers willing and ready to assist them.

TAR AS FUEL.

A Paper read by Mr. T. Bower, of West Hartlepool, at the Meeting of the North of England Gas Managers' Association last Saturday.

Six years ago, I had the privilege of reading before this Association a paper on "Tar as Fuel." At that time you will remember that tar, even at the low prices then ruling, was in many instances almost unsaleable; and a desire to increase its market value caused it to be consumed by many in place of coke in the retort furnaces. That such consumption was wholly, or even partially, responsible for the higher prices since obtained for tar, I am not prepared to say; but we are all well aware that, soon after the introduction of tar firing (which provided a new outlet altogether for part of our tar), its value began to increase, and continued to do so, until it reached a figure that made it no longer profitable to use it as fuel. This has continued up till quite recently; but there seems to be again coming upon us one of those periods of trade depression which not only very considerably reduce the price of gas companies' residual products, but tends to stagnate and paralyze the various trades throughout the country. This, therefore, seems to me to be an opportune time to again consider the subject of "Tar as Fuel."

You will remember that, about the time mentioned, several very able papers were read before other Associations, describing different methods of consuming the tar, and also giving its value as a fuel. Upon the method of burning, I do not propose to say anything to-day, but rather to look at the matter from a purely commercial point of view. Will it pay, with tar at its present low value, to use it in place of coke for retort-firing? To determine this, it will be necessary for each one to carefully study his own circumstances and resources.

It will be within your recollection that, at the time named, tar was at such low prices that a suggestion was made by Mr. George Livesey that all gas companies and corporations should burn 30 per cent. of the tar they produced. I am, however, of opinion that a better method would be for each company and corporation to consider carefully the data which is within their reach—whether, at the prices now obtainable for tar, it might not be more profitable to burn it than coke (always, of course, making allowance for any probability of the extra coke thereby thrown upon the market reducing the value of that article); and should it be found to be an advantage, then I take it to be the duty of each one of us not to limit ourselves to 30 per cent., but to consume as much as possible of the total production, with a view to increasing the value of the portion left for sale.

Taking my own experience, I found that, after having worked some little time, the average quantity of tar used per ton of coal carbonized was about 30 gallons; or, in other words, 7½ gallons of tar are equal to 1 cwt. of coke. On this basis, I should not be at all surprised to find that, in many instances in this locality, it would be more economical to burn tar and sell the coke now used. But on this point each one of you will be best able to decide for himself, after comparing the relative value obtained for tar and coke.

I will, with your permission, now read, from the "Reports of Gas Associations," some of the statistics which I gathered six years ago; and, although the prices may now be somewhat altered, they may still serve to emphasize the point I desire to bring before you—viz., that while it may be profitable to some to consume tar as fuel, to others it may be both a loss and an inconvenience. As I remarked in 1886: "From particulars I have received from various gas-works in our own immediate neighbourhood (most of the managers of which are members of this Association), I find that, taking as the basis of calculation the results I have given as my own experience, there are many to whom it would be a considerable saving to consume the whole of their tar, and dispose of the coke now used in their furnaces. For instance, there are ten companies whose average yearly make of gas is each about 24 million cubic feet; the price realized for coke, 11s. 8d. per ton; and the price of tar, 5s. 3d. per 100 gallons. Now, all these companies could have disposed of 20 per cent. more coke without affecting their present prices. By the use of 150 gallons of tar, at a cost of 7s. 10½d., in place of one ton of coke, a margin of 3s. 9½d. per ton would be left. From this amount must, however, be deducted the cost of supplying steam, and the pumping of tar to the cistern (which will necessarily vary very much according to the circumstances at each works), say, 6½d. per ton, which would leave a net gain of 3s. 3d. per ton for the extra coke to be sold. There are ten other companies, whose yearly make of gas is each equal to about 300 million cubic feet; the average price of coke, 7s. 2d. per ton; and tar, 4s. 2d. per 100 gallons. The saving in these cases, after making allowance for the cost of steam, &c., would be equal to about 4½d. per ton. Eight of the works could have disposed of 20 per cent. more coke; one of them is doubtful; and the other could not have sold any more at the price now charged. On the other hand, there are ten works whose average yearly make is each equal to about 48 million cubic feet; the average price of coke 5s. 7d. per ton; and tar sells at 8s. 2d. per 100 gallons. To burn tar in these cases would entail a loss of more than 6s. per ton for the extra coke they would have for sale; many now finding their coke a drug in the market, even at the present low prices. From this information it will be seen that there is much scope for tar to be used as fuel without affecting the existing value of coke. If the first ten works mentioned burned all their tar, and the second ten (say) 50 per cent., leaving the last ten to sell all they produced, the effect would be to limit the quantity to be disposed of to the tar distillers by the 30 works to something like 60 per cent. of their total production—a system which, if universally adopted, would surely tend to increase the value of this residual, and would be a boon to distillers, who, I understand, would be glad to see the market rid of some of its surplus tar."

THE MEASUREMENT OF PRESSURE PRODUCED IN GASEOUS EXPLOSIONS.

In the JOURNAL for the 9th of August, it was mentioned that a paper on "A New Method of Measuring the Pressure Produced in Gaseous Explosions" was read in the Chemical Science Section of the British Association, at the recent annual meeting in Edinburgh, by Mr. B. Lean and Mr. W. Bone, who also contributed one on "The Explosion of Ethylene." The latter appeared in the next issue of the JOURNAL (p. 296); and we now give an abstract of their other communication.

The authors have devised a new method by which they hope to be able to measure the pressure produced on the explosion of gaseous mixtures. All former measurements involve the motion of a gauge of considerable mass. Bunsen measured the pressure developed by studying the limiting weight raised by a valve attached to a bomb. Berthelot and Vieille determined the rate of displacement of a piston of known section and mass. MM. Mallard and Le Chatelier have employed a Deprez manometer, and also a metallic Bourdon gauge. Mr. Dugald Clerk has made use of a Richards indicator. But in consequence of the instantaneous character of gaseous explosions, it is doubtful whether, by the means employed by these experimenters, it is possible to measure the real pressure produced by the explosion. Their methods would appear to measure no more than the effective pressure.

The authors announce preliminary experiments in which they have studied the pressure produced by a mixture of two volumes of hydrogen with one volume of oxygen. They attached to a leaden coil of 2 litres capacity a strong glass tube of from 10 to 25 c.c. capacity, closed at one end, and separated at its other end from the coil by a gas-tight steel cap, the bore of which had the same diameter as the glass tube. The glass gauge had previously been calibrated and graduated. The coil was then filled with the explosive mixture, while the glass gauge was filled with air or hydrogen. The instant the mixture was fired, the tap separating the coil from the gauge was opened, and the flash due to the exploding gases darted into the gauge. The experiment consisted in taking a photograph upon a sensitive plate of the flash in the gauge. It was found possible to obtain photographs which showed the flash to come to a well-defined and abrupt termination; marking the volume into which the air in the gauge had been compressed. By this means the authors hold that the air in the gauge is compressed adiabatically; and with the data afforded by the photograph, they contend that it is possible to calculate the pressure produced in the explosion by Rankine's well-known formula—

$$P' = P \left(\frac{V}{V'}\right) .$$

The assumption is therefore made that there is no loss of heat up to the time that the flash attains its farthest limit. To obtain some data to justify this assumption, the authors took a photograph of the flash upon a swinging plate attached to a pendulum chronograph. The plate moved past the flash at the rate of 2½ metres per second; and the photographs so obtained could scarcely be distinguished from those taken upon a stationary plate. They were perfectly symmetrical; and only the slightest possible increase in breadth could be detected.

These photographs showed that the compression is approximately instantaneous, and that the flash ceases to have any sensible photo-chemical action in an interval of time less than 1-5000th of a second. In so short an interval of time, the compressed gas cannot lose a sensible quantity of heat. It would appear, therefore, right to assume that the compression is adiabatic. The authors believe also that no appreciable diffusion of the compressed gas into the compressing gas can possibly occur during the very brief time of compression. Further, since thermo-dynamic theory proves the ratio of the two specific heats of any perfect gas to be approximately constant for all temperatures and pressures, Rankine's formula may be employed to calculate the pressure produced by the explosion when the gauge is filled with air or hydrogen. Essentially, therefore, the method gives a record of the adiabatic compression of a gas by the explosion; a piston of indefinitely small thickness and mass being interposed between the compressed and compressing gases.

Experiments have been made with gauges of different volume, varying from 11·55 c.c. to 23·20 c.c.; and the ratio $\frac{V}{V'}$ is found to be independent within these limits of the volume of the gauge. Further, the ratio $\frac{V'}{V}$ is found to be the same, within the error of experiment, whether air or hydrogen is the gas compressed. The photographs obtained, however, in the case of hydrogen, show the flash to be in general ill-defined and pointed; owing probably to the high thermal conductivity of hydrogen, combined with a much greater inter-diffusion with the compressing gases consequent on the greater molecular velocity of hydrogen in comparison with that of hot air. The mean value from six different sets of experiments with air and hydrogen, electrolytic gas being the explosive mixture, gave $\frac{V}{V'} = 8{\cdot}6$. Calculating P′ by means of Rankine's formula, and taking $k = 1{\cdot}408$, it is found that P′ = 20·7 atmospheres. This pressure is about twice that measured by former experimenters.

The authors state that the idea upon which their method is based was suggested to them by Professor Harold B. Dixon.

COAL ANALYSIS.

As a further contribution to the above question, which, as our readers will remember, formed the subject of an important paper by Mr. J. M'Crae at the last meeting of the North British Association of Gas Managers (see *ante*, p. 246), we reproduce, from the *Chemical Trade Journal*, a translated summary of the conclusions arrived at by the Association of German Gas-Works Chemists, who, at their recent meeting at Frankfort-on-the-Main, under the presidency of Herr Schiele, made the testing of coal one of the principal matters for discusssion.

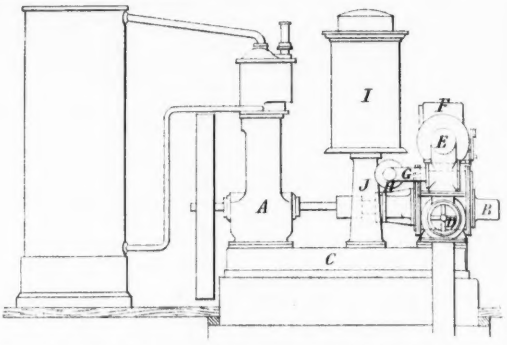
Chemical Tests.—The chemical examination of raw materials for gas distillation is of importance, and should always precede testing on the large scale. The complete chemical examination of gas coals, after careful sampling, can be made the basis of uniformity of supply. The points to be attended to are water, ash, sulphur, coking, and percentage analysis. The first four should be frequently tested. As to the apparatus employed in the testing, it is desirable that each gas-works should have standard laboratory coal-testing apparatus, by which the fitness of the coal for gas making, and any material differences in the lighting power, may be determined. The Association should also arrange to acquire a set of the testing apparatus employed in England, for occasional use.

Physical Tests.—As to testing on the large scale, this should always be done; and the tests are always more reliable the greater the quantity of coal distilled, and the greater the duration of the experiments. Not less than 5 tons should be used, in not less than 24 hours. Tests with one retort should not be admitted. There ought to be a testing-bench, with its own condenser and purifier. Where this is not available, the whole works should be drawn upon in the summer time; or particular benches may be arranged so that tests may be made, at constant temperature, adjusted to the particular kinds of coal—Princeps alloys being the simplest means of regulating the heats. The coke should be extinguished with a watering-pot, and the least possible quantity of water; and it should be weighed the next day. The volume of gas should be reduced to 59° Fahr.; barometric and hygrometric corrections are not necessary. The tar and liquor should be carefully measured and tested; and the gas tested, before purification, for carbonic acid, sulphuretted hydrogen, and ammonia. The lighting power should be tested every quarter of an hour, with a hollow-top slit burner, using from 4 to 5¼ cubic feet; the observations being reduced to a consumption of 5¼ cubic feet (150 litres) per hour. The product of the total number of cubic metres per ton into the number of candles per 5¼ cubic feet per hour is called the "lighting value" of the coal. Otherwise, the number of candle-hours obtainable from a ton of the coal may be stated. In testing the gas, its specific gravity, the total sulphur, and the particular luminous hydrocarbons (benzol, ethylene, methane, &c.) should be ascertained; the methods of gas analysis to be afterwards compared and conferred upon by the Association, with the view of uniformity in statement of results,

REGISTER OF PATENTS.

Combined Gas Engine and Exhauster.—Waller, G., of Park Street, Southwark. No. 14,457; Aug. 27, 1891.

This invention has for its object the arrangement of a gas-engine with a gas-exhauster, disc-valves, self-acting bye-pass valve, throttle-valve, and governor, by which all are combined together and self-contained on one base-plate.



The gas-engine A is coupled directly, or with friction clutch, to a gas-exhauster B—both being fixed on one base-plate C. The disc-valves D on the exhauster are placed horizontally, so that branches on their stems will carry, by two bends E, an automatic bye-pass valve F over the exhauster. Branches G, on the side of the bends, carry a throttle-valve H, which is actuated by a governor I, placed on a standard J bridging the engine and exhauster shaft.

The exhauster is of the usual rotatory type—made with two or more revolving blades—such as is ordinarily used to remove gas from the hydraulic main. The automatic bye-pass valve has a metal flap hanging lightly on turned pins, so as to pass the gas through it when the exhauster is not in action. The governor consists of a cast-iron tank containing water, in which is a light sheet-iron bell. In the centre of the tank is a wrought-iron pipe rising above the water. The pipe is connected to the inlet of the exhauster; and as the bell rises or falls it acts on the throttle-valve, by opening or closing it, to maintain any desired vacuum.

Gas-Fires.—Leach, A., and Greenwood, E. P., of Manchester. No. 17,485; Oct. 14, 1891.

This invention relates to gas-fires in which metal fretwork becomes incandescent by means of a number of Bunsen gas-flames. It is proposed to arrange narrow fret castings across the fire space, in a vertical position—one above another, and in two or more rows in front of each other—mounted on bearers or fret holders, one on each side of the fire, with U projections to receive the frets. The projections are so arranged that, when the frets are in position, the bottom edge of the lower casting in the front row is about level with the tops of the nipples of the Bunsen burner; and the bottom casting behind will thus stand about half the width of itself higher. When a number have been put across the fire space vertically and above each other, the back row will finish about half the width of the castings above the front row. The castings are interchangeable; so that, when the bottom ones show signs of decay with the heat being more intense in some parts than others, they can be changed, and thus allow the whole set to be completely worn out before being replaced by new ones. A number of large lumps are arranged on the brick, directly over the top of the castings, so that they stand further out than the other castings, and prevent the heat from passing away too quickly.

Starting Gas-Engines.—Fielding, J., of Gloucester. No. 19,517; Nov. 11, 1891.

In starting gas-engines according to this invention, the crank is put slightly forward of the dead-centre nearest to the cylinder. Gas is then admitted to the combustion chamber; an outlet-cock being open to allow of the escape of air therefrom. The cylinder thus being practically filled with gas, the inlet and outlet cocks are closed; and sufficient air under pressure is admitted to constitute with the gas an explosive mixture. This is then ignited by any suitable means—such as a hot-tube igniter, or electric spark. The resultant explosion drives the piston forward; setting the engine into motion with such force as to maintain it in action until the ordinary working cycle comes into operation. It is found advantageous, says the patentee, to charge a reservoir during the compression strokes of the engine piston; the gas being suddenly turned off while the engine is running—a suitable non-return valve and cock being provided for this purpose between the engine cylinder and the reservoir.

Sealing the Joints of Metal Pipes.—Lewis, R. W., of Wolverhampton. No. 20,491; Nov. 25, 1891.

This improvement in sealing or perfecting the joints of metal pipes or tubes used for conveying liquids, steam, gas, or compressed air (when the pipes are joined together by being screwed into tubular screw sockets) consists in causing the superfluous white or red lead, or other sealing cement, in the interior of the screw socket to be deposited—on the screwing home of the pipes or tubes—in annular recesses left between the reduced conical or concave ends of the pipes and the interior of the socket; thereby forming rings, layers, or packings of white or red lead between the reduced ends of the pipes and the interior of the socket, so as to fill up the interstices between the screwed ends of the pipes and the socket, and form a perfect joint.

Electric Lighting Attachment for Gas-Burners.—Quinn, D. J., of Brookline, and Hoffmann, P. W., of Boston, U.S.A. No. 20,827; Nov. 30, 1891.

This electric-lighting attachment for gas-burners is designed to allow of a considerable movement of the gas plug or valve, in order to avoid danger of leakage; also to provide improved mechanism for actuating the spark-striking arm.

The burner is provided with a rotatable plug or valve, to control the passage of gas to the burner; and fastened upon its projecting end is a spark-striking arm, adapted to co-operate with a fixed insulated contact on the burner adjacent to the tip, so as to produce a spark which will ignite the gas, when the valve is turned to cause a movement of the spark-striking arm with relation to the fixed contact. The spark-striking arm is provided with two ears or projections, with which co-operate one or the other of two projections on a vertically moveable frame, which, when drawn down by a suitable pull against the action of a spring, will act alternately on one and then on the other of the ears on the spark-striking arm, in order to throw it first in one and then in the other direction, and thus move the valve to open and close the gas-passage, and also to strike a spark.

Propelling Tramcars by Gas Motors.—Yeomans, F., of Sheffield. No. 12,559; July 7, 1892.

In his specification, the patentee remarks that various attempts have, from time to time, been made to invent mechanism or gearing which would permit of portable gas or other motors being applied as tractive power. But the appliances hitherto designed to transmit the power from the engine to the wheel axle of the car or other vehicle—however excellent they may be theoretically—have proved in practice unsuitable for general use, on account of their either taking up too much space, and thus requiring a departure from the ordinary form of car, or be fitted up in a car by themselves to which the tramcar has to be hung on, or of their being too noisy or unreliable in their working, and communicating the vibrations from the motors to the car. The object of the present invention is to obviate these drawbacks, which is effected by fitting up two double-cylinder portable motors of ordinary construction, one on each side of the car; and by means of specially-arranged gearing, these are caused to drive the car backwards or forwards, and either quickly or slowly, as may be desired (or the car may be stopped), although the motors are always working at one speed and in one direction.

Fluid Meters.—Holt, F. W., of St. George, New Brunswick. No. 13,214; July 19, 1892.

This fluid meter consists of a cylinder, a piston moving therein, an outwardly projecting rod operated by the piston, and registering and valve-operating mechanism, set in motion by the rod. The meter is of the piston type; and the invention refers more particularly to the manner in which the cylinder valves are operated by the mechanism arranged for the purpose, in which the power for throwing the valves is derived from a spring held in torsion. The object of the invention is to construct a meter which will accurately measure the quantity of fluid passing through it; the mechanism being extremely sensitive and capable of exact adjustment.

Production of Fuel Gas.—Bailey, J. M., of Bristol, U.S.A. No. 13,339; July 21, 1892.

This invention relates to the production of fuel gas from crude petroleum oil; the apparatus being shown in longitudinal section and in cross section through A^1 in fig. 2, and through A^2 in fig. 3.

Fig. 1.

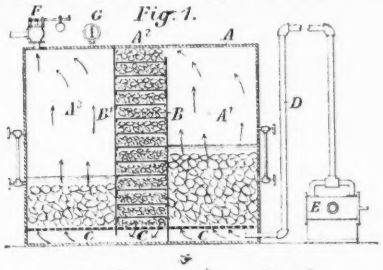
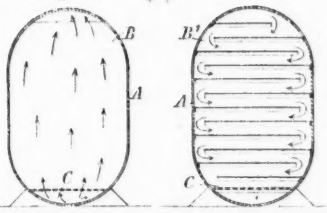


Fig. 2. *Fig. 3.*



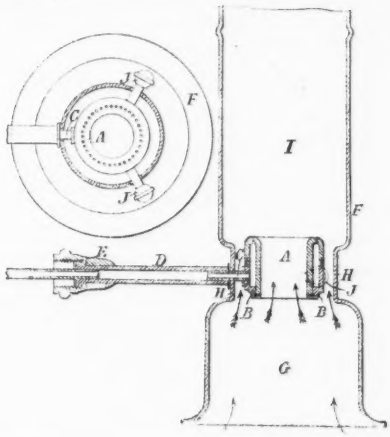
The manufacture of the gas is conducted in a closed tank or vessel A, within which place are two diaphragms or partitions B and B^1, which divide the tank into three compartments. The diaphragm or partition B extends from the bottom nearly, but not quite, to the top of the tank; while B^1 extends from the top almost to the bottom. A screen or grating C is placed in each compartment a few inches above the bottom; and upon this screen (in the compartments A^1 and A^3) is placed a quantity of broken stone, shells, metallic scrap, or other analogous material. The middle compartment A^2 is provided with a series of shelves, which extend alternately from opposite sides of the compartment nearly to the other side; and the spaces between these shelves are likewise filled with the broken stone or other analogous material. The compartment A^1 is adapted to receive, near its bottom, a constant supply of air, forced in through a pipe D by a pump E. The compartment A^3 has, near its top, a connection with a pipe F, through which the gas is led off. The compartment may also be provided with a pressure-gauge G, and with a relief-valve H.

In the use of the apparatus, the compartments A^1 and A^3 are filled with crude petroleum to about the height indicated. Atmospheric air, preferably somewhat heated, is then forced through the apparatus, and is compelled to travel a considerable distance through the oil. The bubbles are thus so thoroughly broken up by their passage through the broken stone, that the particles of air are brought into the most intimate contact with the oil. The result is, that the air is thoroughly carburetted, and a gas produced which is sufficiently permanent for all practical purposes; will not condense under ordinary temperatures; is highly inflammable; and produces, when ignited, an intense heat.

The material in the compartment A^2 may be saturated with oil whenever desired, by stopping the pump E and closing the pipe F—thus allowing the carburetted air in the compartment A^3 to force the air upwardly in the compartment A^2; a vent being provided for the escape of the carburetted air from the compartment A^1. The broken stone or other material may thus be kept always in proper condition, even if it should prove necessary to saturate the material in the compartment A^2 at frequent intervals.

Gas-Burners.—Gary, P., of Toulouse, France. No. 13,656; July 27, 1892.

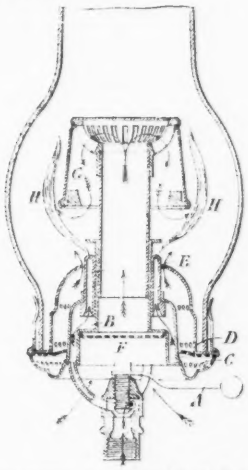
This burner is composed of an annular casting A (with a series of holes in its upper side for the egress and combustion of the gas) fixed in a holder B, which, in combination with it, forms the reservoir of the gas flowing through the tube C attached to the holder. This tube forms a regulator according to its interior diameter, and is itself joined by a branch-pipe D to the boss E, which serves for fixing it to the gas-supply pipe. Thus arranged, the burner is fixed at a convenient height in the vertical centre of the glass chimney F, in the narrow part H. The lower part G is widened, and forms the aspirator to draw in the air; while the upper part I forms a chimney.



The burner is supported in the glass by two rods J, passing through holes in the glass and screwed into the walls of the holder B, and by the tube C, which passes through a hole formed in the glass. The air, following the direction of the arrows, becomes heated by contact with the glass and with the whole of the burner, and is split up, passing, the one part through the centre of the burner and the other part around it, in such a manner as to feed the flame both inside and out.

Gas-Lamps.—The Lamp Manufacturing Company, Limited, of Leonard Street, City Road, and Welsh, W. H. I., of Coborn Road, London. No. 13,697; July 27, 1892.

This invention relates to a lamp in which a bulbous gas-flame is supplied externally with air, heated by conduction from the parts under the flame, and also supplied internally with air heated by passing through a chamber above the flame.



The gas on entering passes a screw-valve with a handle A, by which the supply can be regulated; ascends by three or more bent tubes to a chamber B; and thence through the perforations of an Argand burner

to form a cylindrical flame. Air for supplying the exterior of the flame passes through perforations C, into an annular chamber; whence part of it issues by lateral perforations D, and part at E, between the burner and the inwardly-turned lip of the casing of the main chamber. Air to supply the interior of the flame enters, through perforations F, a central tube, which terminates in a grating within a chamber G. From this chamber, the heated air descends, as indicated, to the flame H. By means of a projecting flange, which acts as a deflector, and by the direction of the air current, this flame is expanded into a bulbous form; and as it is supplied externally with air heated by passing along the surfaces under the flame, which are heated by conduction, and internally with air heated by passing through the hot chamber G, the combustion is said to be very complete, and the light produced of great brilliancy. The glass chimney is in its lower part of bulbous form, to suit the shape of the flame; and above that part, it is carried np to the usual height in cylindrical form.

APPLICATIONS FOR LETTERS PATENT.

16,750.—GREIN, F., "Charging-machine for gas-retorts." Sept. 19.

16,818.—KNIGHTLY, W., "Construction of drain, water, gas, and other pipes, and the method of joining the same." Sept. 20.

16,911.—HOUSE, H. A., HOUSE, H. A., jun., and SYMON, R. R., "Burners for the combustion of gas or vapours for heating purposes." Sept. 22.

16,986.—WHITTAKER, G., "Ignition-tubes for gas-engines." Sept. 23.

16,998.—GREEN, H., "Apparatus applicable to gas and other meters for arresting the same when a determined quantity of gas or other fluid has passed." Sept. 23.

16,999.—HARRISON, C., "Preventing the bursting of water-pipes by freezing." Sept. 23.

17,036.—BELL, J. F., "Regenerative gas-furnaces for heating retorts." Sept. 24.

17,057.—DOBBIE, A. B., "Indicators for gas, petroleum, and other engines." Sept. 24.

17,067.—COLLET, H., and MERICHENSKI, M., "Making gas, and a compound therefor." Sept. 24.

17,110.—THOMAS, T. C. J., "Regenerative lamps." Sept. 24.

An Unprofitable Gas Undertaking.—The report and accounts of the Thornbury Gaslight Company for the past year afford anything but pleasant reading for the shareholders. The total expenditure, it appears, amounted to £1135, and the receipts to £1007; so that there was a loss of £128 on the working. In consequence, the Directors cannot recommend the payment of a dividend; but, as the plant and machinery at the works are now in thorough order, there is every prospect of a profit being made on the current year's operations.

The Heckmondwike Local Board and Electric Lighting.—The electric lighting question of Heckmondwike is responsible for proceedings at the last meeting of the Heckmondwike Local Board which are described by a Bradford paper as the "most unruly within the annals of that body." A resolution authorizing the Board to take the needful steps for lighting the town with electricity was discussed at a previous meeting; and, by a unanimous vote, it was held over until the matter had been submitted at a meeting of owners and ratepayers for their decision. As announced in last week's issue, the ratepayers have given their consent; and in consequence, the resolution was re-introduced for discussion at the meeting of the Board yesterday week. Its acceptance having been moved and seconded, Mr. J. Walshaw spoke in opposition, on the ground that the town could not afford to be involved in additional expenditure. Mr. Macaulay proposed that the whole matter should be referred back to the Committee; arguing that their investigations were incomplete. Mr. Redfern commented in strong terms upon the position taken up by Mr. Walshaw, who was a member of the Electric Lighting Committee, and had, moreover, given his consent to the Committee's report. A heated discussion ensued, in which some personalities were exchanged, and rather strong language was employed. Eventually a vote was taken; and the amendment was declared carried by five votes to four. It was afterwards pointed out that, unless some move was made in the matter, the Provisional Order would expire in June next; and a fresh Committee was then appointed to make further inquiries.

New Electric Lighting Schemes.—The electric lighting of the Smithfield Markets under rather a novel scheme is rapidly approaching completion, and will (we learn from *The Times*) very soon be formally inaugurated by the Lady Mayoress, who will be accompanied by the Lord Mayor. Under the terms of the contract, which is being carried out by Messrs. Julius Sax and Co., on behalf of the Corporation of London, the tenants of the market will not be put to any expense in the installation of the light upon their premises; and they will only be charged the same amount that they have been paying for gas. In addition to 100 lamps for the avenues, there will be 8000 lamps of 50-candle power each for lighting the shops. The same paper states that proposals are being made for lighting by electricity the various riparian towns of the Lower Thames Valley. Activity at the present moment has been provoked by the action of the Brentford and Richmond Gas Companies in giving notice of an increased charge of 3d. per 1000 cubic feet in the ensuing quarter. The Richmond Town Council have sealed a contract with an electric lighting company, and the works are already in progress. The Chiswick Local Board, have applied to the Board of Trade for their sanction to a contract with Messrs. Bourne and Grant for the electric lighting of the parish; and the contractors are ready to proceed. The Twickenham Local Board, at their meeting a few days ago, passed a resolution of protest against the extra charge, and referred to the Lighting Committee the consideration of some other mode of lighting the town. The Heston and Isleworth Local Board, who have the largest area of any urban sanitary authority in the kingdom, also recorded a protest against the increased imposition, and warned the Brentford Gas Company that, if proceeded with, the Board would consider the question of lighting the district by electricity. The Brentford Local Board have hitherto confined themselves to protest; but, according to our contemporary, the feeling among the members is so strong that they are not unlikely to follow the example of their neighbours.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

Mr. Gadd's Mechanics.

SIR,—With all due respect to Mr. Gadd, I cannot undertake to reply to every little thing in his letters. He raises so much "dust" that it would require oceans of time to lay it. Hence, in calling attention to what I consider errors in his writings, I can only deal with them in a general sense—going straight to the root of the matter at once.

I contend the principal part of Mr. Gadd's article in the JOURNAL for Aug. 9, was an attempt to throw doubt upon Mr. Cripps's determination of the pressure upon the tank-guides in the Gadd patent gasholder (see JOURNAL for Nov. 11, 1890), and in no respect referred to the diagonal stresses which Mr. George Livesey said he (Mr. Gadd) had ignored in his Gas Institute paper. The attempt which Mr. Gadd made was doubtless due to not comprehending Mr. Cripps's article, above alluded to. I cannot undertake, nor do I consider it my duty, to instruct Mr. Gadd in the principles of mechanics, or to prove that his errors are errors. It is sufficient to warn those who might easily be led astray, that his system of mechanics is very dubious.

Mr. Gadd in his last letter says Mr. Cripps's formula "must" either be proved or withdrawn before he (Mr. Gadd) can proceed. I am not aware that anyone compels Mr. Gadd to proceed; and after what he has already subscribed to in the JOURNAL, one can scarcely accept him as an authority either in the principles of mechanics or in their application.

The formula Mr. Gadd inserts in his last letter is one of his own devising, and was never used by either Mr. Cripps, or referred to by myself. But I cannot waste your space, and my time, in proving even this. It is, however, amusing to note that Mr. Gadd's own formula (and now ascribed to me) is at last denounced by himself as absurd.

If your readers are sufficiently interested in determining the pressure on the tank-guides in the Gadd and Mason gasholder, they will find it clearly and correctly set forth in Mr. Cripps's article in the JOURNAL for Nov. 11, 1890.

Mr. Gadd may find all he wants respecting the difference between what Professor Rankine terms "geometrical and mechanical" moments of inertia, in one at least of Professor Rankine's works; and he should know that the moment of inertia can be applied to lines or plane areas, and not simply to solids having weight. Mr. Gadd objects, in his letter in the JOURNAL for Sept. 13, that, if the gasholder be "deprived of weight, . . . the moment of inertia cannot come into the problem." I would ask him how can it apply then to lines or areas, which have *no* weight at all; and yet Rankine so applies it.

In conclusion, engineers need no proof that Mr. Gadd's quotations are inapplicable; neither do they require proof that Mr. Gadd is wrong in other respects. Sometimes error is wrapped up, however, in such subtle clothing as to appear truth. It is, therefore, perhaps desirable (for the sake of beginners and others) to give a hint now and then to prevent them being led astray by what appears at first sight to be truth, owing to the plausible manner in which it is advanced. This is my sole reason for drawing attention to the matter, and not—as Mr. Gadd endeavours to impress your readers—to do "a serious wrong to a known professional man, calculated to possibly injure him very materially."

If Mr. Gadd adopts the *rôle* of an apostle of error, he must take the consequences—however pitiful—when attention is drawn to it.

Sept. 29, 1892. R. J. MILBOURNE.

Regenerative v. Ordinary Settings.

SIR,—The President of the South-West of England District Association of Gas Managers stated, in his excellent Inaugural Address at the meeting of that Association recently held at Bournemouth, that the regenerative furnaces introduced into this country some time ago had not made the progress which was anticipated; and why this should be so was somewhat difficult to determine. I have thought, in reading these remarks, that at least one reason is the extra cost incurred in building these furnaces, considering the results achieved, which are apparently very little, if any, better than those obtained from ordinary settings. I notice it was recently stated in the JOURNAL that at one works they expect to make 5200 cubic feet of gas per mouthpiece with regenerative furnaces; and at another 6600 and 7000 cubic feet. We have heard of very small works making from 6000 to 7000 cubic feet per mouthpiece with ordinary settings. At my own we are producing 7000 cubic feet with retorts 21 in. by 15 in. and 9 feet long in ordinary settings, while our fuel account for last year was 10·26 per cent.; and we hope to do as well this year. When such results as these can be attained, does it warrant managers in recommending to their directors the elaborate and expensive regenerative setting?

Broadstairs Gas-Works, Sept. 26, 1892. W. J. LATCHFORD.

The Quality of the Water Supply of Rotherham.—A paragraph appeared in the JOURNAL for the 13th ult., in which it was stated that questions affecting the quality of the water supply of Rotherham had been raised in a report recently made to the Local Government Board by one of their Medical Officers (Mr. Theodore Thomson). A sample of the water has since been submitted by the Corporation Gas and Water Engineer (Mr. C. B. Newton) to Professor J. A. Wanklyn for examination. The results of his analysis have been published; and they show that the water is "remarkably pure," and "perfectly uncontaminated." It is rather hard; but otherwise no fault can be found with it. There are no traces of poisonous metals in the water; and it is as pure as that supplied in London by the Kent Water Company.—— A report is to be submitted at the meeting of the Town Council tomorrow by the Sub-Health Committee, in which it is recommended, *inter alia*, that immediate steps be taken to remove the sources of pollution set forth in Dr. Thomson's report to the Local Government Board; that the Wellgate spring be disconnected from the water supply; and that the filter-beds at Ulley and Dalton be thoroughly cleansed.

MISCELLANEOUS NEWS.

COMMERCIAL GAS COMPANY.

Half-Yearly Report and Accounts.

The following is the report of the Directors of this Company, which, with the accounts for the half year ending June 30 last, will be presented at the ordinary general meeting of the proprietors to be held on Friday next:—

The Directors submit the accounts for the half year ended the 30th of June, 1892. The revenue account shows a net profit for the half year of £22,285 15s. 4d.; making, with £495 10s. 9d. received for interest, £22,781 6s. 1d. This, added to the amount brought forward from previous half years, makes £41,275 10s. 10d. Deducting therefrom £2925 for interest on debenture stock, there remains standing to the credit of the net revenue account a balance of £38,350 10s. 10d. available for dividend, less the sum of £5, the amount of forfeitures imposed upon the Company in respect of impurity in the gas in December last. The Directors recommend the payment of dividends, at the rates of 13 per cent. per annum upon the old stock of the Company, and of 10 per cent. per annum upon the new stock, both less income-tax. The amount by which the profits of the Company are insufficient to pay the dividends will be taken out of the reserve fund. The Directors have found it necessary to increase the price of gas to private consumers from 2s. 6d. to 2s. 9d. per 1000 cubic feet, after the taking of the Michaelmas indices.

The accounts accompanying the report consist of the usual statements. The statement of capital stock (No. 1) stands as on Dec. 31 last—viz., £715,000 paid up, out of a total of £830,000 authorized. The statement of loan capital (No. 2) shows that £160,762 has been borrowed, out of £300,000 authorized. The capital account (No. 3) shows receipts to the amount of £875,762, of which the sum of £30,762 was raised on debentures during the past six months; and of the total capital called up and borrowed, £850,306 9s. 11d. has been spent (£5063 9s. 3d. in the past half year)—leaving a balance of £25,455 10s. 1d. in hand. The other statements in the accounts are reproduced on the next page.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

Half-Yearly Report and Accounts.

The report submitted by the Directors of this Company at the half-yearly meeting of the proprietors last Friday (the proceedings at which will be reported next week) show that the results of the past half-year's working have not been so satisfactory as was anticipated. The gross receipts amounted to £128,665, while the expenditure, inclusive of £5206, the interest paid on loan capital, &c., reached £106,835, leaving a net profit of £21,830, to which has to be added £335 brought forward from the previous accounts; making a total balance to the credit of profit and loss account of £22,165. The Directors regret the accounts do not show so satisfactory a result as they expected. Nevertheless, believing the diminution in profit is only of a temporary nature, they recommend the payment of the usual dividend of 10½ and 7½ per cent. per annum on the respective shares, although this recommendation will involve the withdrawal of £11,691 from the reserve fund. Should this recommendation be adopted, there will then remain to the credit of that fund £51,125, inclusive of £1146 interest received during the half year on the invested reserve. This diminution in the profits is due, the Directors remark, to circumstances over which they have had no control. During the strike of the Durham miners, which lasted three months, all deliveries of coal from that district were suspended; and the Company's contractors at Newcastle, being unable to obtain them at any price, the Directors were obliged to procure them from other sources, such as Lancashire and Scotland. This led to a considerable increase in the gross expenditure for coals, as, from their poor quality, the yield of gas per ton was considerably reduced; and hence it became necessary to use a much larger quantity to maintain an adequate supply. Unfortunately, while the cost of raw material was advancing, the market value of all classes of residuals declined—coke in particular, which only realized £14,350, against £17,349 during the corresponding period. The extra cost of coal and cannel, added to the loss on coke sales, was £12,342. There has been a very considerable increase in the quantity of gas sold during the half year, amounting to about 28 million feet, and arising from the extensive use of gas for cooking and heating purposes, in addition to a large quantity consumed in gas-engines for motive power.

BRITISH GASLIGHT COMPANY.

The Half-Yearly Meeting of this Company was held last Wednesday, at the London Offices, 11, George Yard, Lombard Street. The profit and loss account which was presented contained, on the credit side, the following items: Balance brought from last account, £47,469; rents, £126; interest, £1444; Clonmel rent, £83; Hull profits, £6625; Norwich do., £7117; Potteries do., £3738; Trowbridge do., £1375; Holywell do., £316; Yarmouth tar distilling profit, £29; Yarmouth sulphate of ammonia, £116; Hull reserve fund for deficiency of profit at this station, £2837; Potteries reserve fund for deficiency of profit at this station, £600—making a total of £71,878. On the opposite side of the account, the following items appeared: April dividend and bonus, £22,500; income-tax, £554; Potteries mortgage debenture interest, half-year's interest, less income-tax, £170; Norwich surplus profits, amount transferred to reserve fund, £512; Trowbridge surplus profits, amount transferred to the reserve fund, £220—leaving a balance of £47,921. The reserve funds account showed that the balance on Dec. 31, 1891, was £43,482; and, adding to this the Norwich surplus profits £312, the Trowbridge surplus profits £220, and interest on investments £615, made a sum of £44,831. From this there had to be deducted the deficiency of the Hull profits £2837, and the deficiency of the Potteries profits £600—the balance remaining being £41,393. The report and accounts were adopted. A dividend was afterwards declared at the rate of £1 per share for the half year ended June 30 last, clear of income-tax; and also a bonus of 2s. 6d. per share. The retiring Directors (Messrs. H. Wilkin and Corbet Woodall) were re-elected; and the thanks of the shareholders were given to the Chairman (Mr. J. Horsley Palmer), the Directors, and the Secretary (Mr. Frederic Lane Linging) and officers.

HARROW DISTRICT GAS COMPANY.

The Half-Yearly Meeting of this Company was held yesterday week, at Winchester House, Old Broad Street, E.C.—Mr. JAMES GLAISHER, F.R.S., in the chair.

The SECRETARY (Mr. J. L. Chapman) read the notice convening the meeting; and it was agreed to take as read the report and accounts, which were referred to in the JOURNAL for the 13th ult. (p. 481).

The CHAIRMAN, in moving the adoption of the report and accounts, said he had had on previous occasions to speak of the anxiety that had reigned over the gas industry generally for some time past. That anxiety had not yet entirely passed away; but he thought they had got over the worst of it. He had no doubt this feeling of apprehension had caused the shareholders to look forward with interest to the publication of the balance-sheet, to see whether or not the Company had held their own. The accounts showed that the dividend proposed had been earned. As to the accounts, the expenditure for coal had been £1651, which was an increase of £59 over the cost for the corresponding period of last year. He thought that this was a good feature, because it implied that they had had to carbonize more coal; and therefore had done a larger business. The total expenditure on revenue account during the half year had been £2998, or an increase of £40. Looking at the opposite side of the account, they would find that, up to Lady-day, they had had a revenue in excess of that for the corresponding period of the previous year of £307 odd; and the Directors had hoped this increase would continue over the whole six months. But there were ups and downs in all businesses, and hopes and fears were sometimes disappointed; and so it had been with them. In the Midsummer quarter, instead of having an increase, they had had a decrease of £42; and this had, therefore, brought the increase over the half year down to £265. To this must be added an increase of £12 for meter and stove rentals, which made the revenue £276 more than in the corresponding half of 1891. He had now to refer to the dark side of the balance-sheet—the receipts for residual products. They had received £103 less for coke, £50 less for tar, and £32 less for sulphate of ammonia; so that the fall in the value of the residuals had taken £185 out of the £276 already alluded to, leaving them with a net increase of £90 on the revenue account. He recollected well the time when tar was made available for the production of aniline dyes; and madder, which was then the only material used for the purpose, went completely out—indeed, the farmers had ceased to cultivate it at all. Then it was said that gas companies would make their profits entirely out of the residuals, and would not need to consider the gas at all; but he was glad that this idea had not been followed out. Even now, he did not know of a substitute for anthracene; but through some bad business arrangements or something else, they obtained no money where they ought to get a great deal. If he could have any influence with the tar producers and distillers, he would endeavour to improve the business arrangements, and so procure better results for the industry generally. During the past six months, they had made 18 million feet of gas, which was an increase of 1,038,000 feet. The leakage had been 811,000 cubic feet only, or less than 4½ per cent. on the make of gas. They had produced 10,452 cubic feet per ton of coal carbonized; and of this they had sold 9830 feet. The revenue during the half year had amounted to £4650, and the expenditure to £2998; leaving a profit of £1652. The amount needed to pay the dividends and the interest on their loans was £1650; so that they had just earned the dividend. Considering the adverse circumstances with which they had had to contend, he thought they had done very well, and a great deal of the credit for this was due to the Engineer.

Mr. C. HORSLEY seconded the motion, which was carried unanimously.

On the motion of the CHAIRMAN, seconded by Mr. A. H. BAYNES, dividends were declared of 7½ per cent. per annum on the original "A" capital; 7 per cent., on the first additional "B" capital; and 5¼ per cent., on the second additional "C" capital, all less income-tax.

The services of the Engineer having been suitably acknowledged,

A vote of thanks was passed to the Chairman and Directors, on the motion of Mr. MAGNUS OHREN, seconded by Mr. J. RANDALL.

The CHAIRMAN briefly replied; and the proceedings closed.

The Charges for Electric Lighting in Leeds.—The Yorkshire House-to-House Company are hoping to be in a position to supply electricity for illuminating purposes about two months hence; and in view of this, they have issued a document giving some particulars as to their proposed charges. All accounts (whether small or large) for electricity are to be subject to a discount from the standard price of 8d. per unit, based upon the number of hours per quarter during which the current is used; each consumer being called upon to declare the maximum number of lights required to be in use at any one time. The scale of discounts is as follows: For not less than 250 hours' use (per quarter) of the supply demanded, 10 per cent.; 375 hours, 15 per cent.; 500 hours, 20 per cent.; 600 hours, 22½ per cent.; and 700 hours, 25 per cent. In addition to the discounts accruing under the above table, a discount of 5 per cent. will be allowed on the net amount of accounts paid within one month from the date of rendering, and 2½ per cent. on accounts paid within two months. The effect of the discounts above mentioned is to reduce the price of 8d. per unit to about the following net charges: For 250 hours' use (per quarter), 6¾d. per unit.; 375 hours, 6½d. per unit; 500 hours, 6d. per unit; 600 hours, 5¾d. per unit; and 700 hours, 5½d. per unit.

ACCOUNTS OF THE COMMERCIAL GAS COMPANY FOR THE HALF YEAR ENDING JUNE 30, 1892.

No. 4.—REVENUE ACCOUNT.

To Manufacture of gas—				By Sale of gas—			
Coals, including dues, carriage, unloading, and trimming (see account No. 8)	£82,459 11 3			Common gas, per meter, at 2s. 4d. and 2s. 6d. per 1000 cubic feet	£114,807 0 2		
Salaries of Engineers, Superintendents, and other Officers at works	2,162 0 0			Public lighting and under contracts, common gas. (See statement No. 10.)	9,357 1 9	£124,164 1 11	
Wages (carbonizing)	20,133 3 4			Meter-rental	£1,972 8 10		
Purification, including £1922 10s. 1d. for labour	4,933 16 6			Stove-rental	769 8 0	2,732 16 10	
Repairs and maintenance of plant and works, materials and labour (less £81 2s. 1d. received for old materials)	14,288 12 10			Residual products—			
		£123,977 3 11		Coke, less £3699 12s. 8d. for labour	£23 613 13 6		
Distribution of gas—				Tar	6,760 0 10		
Salaries and wages of Officers (including Rental Clerks)	£2,140 5 7			Ammoniacal liquor and sulphate	9,099 13 5		
Repairs, maintenance, and renewal of mains, service-pipes, and fittings, including labour	1,591 9 0				£39,473 7 9		
Repairs and renewals of meters and stoves	2,030 9 5			Less loss on breeze, after deducting £709 14s. 3d. for wages	53 0 10	39,420 6 11	
		5,762 4 0		Miscellaneous receipts—			
Public lamps—Lighting and repairing		2,213 6 6		Rents	£118 19 6		
Rent, rates, and taxes		5,719 9 7		Transfer fees	29 5 0	148 4	
Management—							
Directors' allowance	£1,250 0 0						
Company's Auditors	75 0 0						
Salaries of Secretary, Accountant, and Clerks	1,108 18 6						
Collectors' salaries and commission	1,493 16 1						
Stationery and printing	442 17 10						
General charges	522 12 5						
		4,893 4 10					
Bad debts		758 16 1					
Law charges		135 18 11					
Superannuations		650 8 0					
Official Officers		69 3 0					
		£144,179 14 10					
Balance carried to profit and loss, net revenue account (No. 5)		22,285 15 4					
		£166,465 10 2				£166,465 10 2	

No. 5.—PROFIT AND LOSS (NET REVENUE ACCOUNT).

Interest on debenture stock	£2,925 0 0	Balance, Dec. 31, 1891	£62,314 0 9
Balance available for dividend, carried to balance-sheet	38,350 10 10	Less amount of dividend paid for half year ending Dec. 31, 1891	43,819 16 0
			£18,494 4 9
		Balance from revenue account (No. 4)	22,285 15 4
		Dividends and interest balance	495 10 9
	£41,275 10 10		£41,275 10 10

No. 6.—RESERVE FUND.

Balance on June 30, 1892	£44,379 5 1	Balance on Dec. 31, 1891	£44,379 5 1
	£44,379 5 1		£44,379 5 1

No. 7.—INSURANCE FUND.

To extra cost of coals during the Durham strike	£4,175 0 0	Balance on Dec. 31, 1891	£33,627 7 7
Balance on June 30, 1892	29,452 7 7		
	£33,627 7 7		£33,627 7 7

No. 8.—STATEMENT OF COALS.

Description of Coal.	In Store, Dec. 31, 1891.	Received during the Half Year.	Carbonized during the Half Year.	In Store, June 30, 1892.
	Tons.	Tons.	Tons.	Tons.
Common	27,418	96,457	109,767	14,108
Cannel	2,302	2,495	*2,920	1,877
	29,720	98,952	112,687	15,985

* In addition, petroleum equivalent to 557 tons was used.

No. 9.—STATEMENT OF RESIDUAL PRODUCTS.

——	In Store, Dec. 31, 1891.	Made during the Half Year.	Used during the Half Year.	Sold during the Half Year.	In Store, June 30, 1892.
Coke—chaldrons of 36 bushels*	31,511	148,397	49,934	105,051	24,823
Breeze do. do.	4,106	17,662	2,667	15,335	3,766
Tar—gallons	371,400	1,070,706	—	1,279,506	162,600
Ammon. liq.—butts of 108 gals.	13 935	88,606	44,101	—	8,440
Sulphate of ammonia—tons	691	1,469½	—	1,931½	229

* Under "Weights and Measures Act, 1878."

No. 10.—STATEMENT OF GAS MADE, SOLD, ETC.

Description of Gas.	Quantity Made. Meter Register.	Quantity Sold. Public Lights and under Contracts (estimated).	Quantity Sold. Private Lights (per Meter).	Quantity Sold. Total Quantity Sold.	Quantity used on Works, &c.	Total Quantity accounted for.	Quantity not accounted for.	Number of Public Lights.
	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	
Common	1,087,689	58,919	960,099	1,019,018	11,964	1,030,982	56,707	5,353

BALANCE-SHEET.

To Capital—				By Cash at Bankers			
Balance per account No. 3		£25,455 10 1				£5,596 5 11	
Net Revenue—				Cash in hand for current expenditure		1,900 0 0	
For balance, per account No. 5		38,350 10 10		Amount invested in Consols		78,006 12 8	
Reserve Fund—				Stores in hand—			
For balance, per account No. 6		44,379 5 1		Coals	£12,253 0 0		
Insurance Fund—				Coke	6,208 6 8		
For balance, per account No. 7		29,452 7 7		Ammoniacal liquor and tar	5,251 10 6		
Unclaimed dividends		1,926 12 6		Sundries	6,982 19 2		
Deposits		9,336 4 8				30,695 16 4	
Interest on debenture stock		164 8 2		Accounts due to the Company—			
Sundry tradesmen and others, for amount due for coals, stores, and sundries		14,856 11 7		Gas-rental, quarter ending June 30, 1892	£45,549 12 5		
Loan from Bankers		5,000 0 0		Arrears outstanding	1,308 12 4		
						46,858 4 9	
				For coke and other residual products	£5,662 1 2		
				Sundries	192 9 8		
						5,854 10 10	
		£168,911 10 6				£168,911 10 6	

A New Water Supply for Hamburg.—The cholera epidemic in Hamburg has aroused the local authorities to a sense of their duty regarding the present water supply. The Berlin Correspondent of the *Daily News* states that Dr. Koch is of opinion that, if within a very short time wells are not bored, so as to make Hamburg independent of the present water-works, the epidemic may increase until it rivals that which raged in 1848, and lasted for several years. As to the improvement of the water supply, several proposals have been made. The boring of artesian wells has been spoken of; and Herr Werner Siemens has submitted a scheme for boiling the Elbe water before it enters the water-pipes. It has been resolved, however, to begin with the introduction of the wells, though the other projects have not been definitely rejected. The boring has already begun at many points in various quarters of the town. The opinion of the Committee who have the matter in hand as to the utility of these wells, which will not exceed a depth of 20 to 24 feet, was divided at first; but after Dr. Koch's assurance that the water supplied by them, though not of crystal clearness, would still be free from bacilli, they passed a resolution in favour of them. If the plan proves a success, the entire water-works, beginning at the place where the water is drawn, will be disinfected with 1 per mille solution of quicklime. The water from the original source would then only be used for cleaning purposes, and not for drinking. A pupil of Dr. Koch will direct the bacteriological examination of the new wells.

BIRMINGHAM CORPORATION GAS SUPPLY.

Report by the Committee—The Coal Contracts—Adoption of Carburetting Plant—The Sutton Coldfield Gas Supply.

Among other business to come before the Birmingham City Council to-day is a report by the Gas Committee, in which they state that Mr. T. H. Hack, analyst and gas tester at the Saltley Gas-Works, has resigned his post on receiving an appointment from the Sheffield Gas Company, and that they have taken advantage of the opportunity thus afforded to rearrange the duties of the office, and at the same time appoint a trained chemist at these works, a portion of whose time is to be employed in research. They have engaged Dr. Colman to this office, at a salary beginning at £300 per annum. An assistant chemist will also be employed to do the more routine portion of the work hitherto performed by Mr. T. H. Hack, which was partly that of a chemist and partly that of an engineer; but the whole of the chemist's work will be under the immediate supervision of Dr. Colman. It is also recommended that the salary of Mr. J. W. Morrison, the Superintendent of the Saltley works, be increased from £250 to £300 per annum from Jan. 1 next. The maximum salary of this office is fixed at £350 per annum; and Mr. Morrison's salary was last increased from £200 to £250 in January, 1890. The prices to be paid for tar by Messrs. Lewis Demuth and Co., Limited, in the current year have been agreed on under the contract with them; but at a very considerable reduction from the prices of last year. Contracts for the coal required for the coming year have been made. The Committee were able, without difficulty, to secure that required at two of the works at a reasonable and satisfactory reduction from last year's prices. It appeared from the tenders received that, at the remaining two works, no reduction would be obtained in some of the districts from which the department have hitherto procured a considerable portion of their supplies, although it was evident, from the large quantity offered, that the state of the market did not warrant the evident combination to maintain prices in those districts. As it was inevitable that the price of gas would have to be immediately raised, unless coal could be bought at a reduction for the whole of the works, the Committee gave mature consideration to the situation. A larger proportion than usual of the lower-priced coal offered was from new sources; and, while this gave satisfactory results from the tests made of the samples submitted, the Committee hesitated to rely largely on new sources of supply, of which they had no experience in actual work. On learning, however, that, in the opinion of the Engineers, this could be safely done either with the security of additional supplies of cannel, or, preferably, by the provision of oil-carburetting plant, the Committee, after first ascertaining that no substantial concession would be made by some of the coal-owners with whom they have had large contracts for many years, determined to take a considerable portion of the new coal offered. By this step, it has been possible to postpone for a time any increase in the price of gas; but although the Committee are most anxious to avoid such a course, the continued fall in the value of all residuals may yet compel them to recommend it at an early date. It was stated in the last report that, in anticipation of the diminishing available supplies of good cannel coal, they were considering the advisability of introducing oil-carburetting plant into the works. On further consideration of the subject—after examination of the tenders for cannel for the current year, and having regard to the strong recommendation of the Engineers already referred to in this report—the Committee have sanctioned an expenditure of £3160 in the provision of the necessary plant for this purpose at all the works. This plant will be in full operation before the end of the year. Under the contracts which have been made for the ammoniacal liquor to be produced at the works in the ten years beginning on July 1 next, the value of this product to the department will be materially increased. With regard to the gas supply of Sutton Coldfield, the Committee remark that, on receipt of the offer of the goodwill and distributing plant of the Company, a valuation was made by Mr. C. Hunt; and he was asked to report if the supply could be satisfactorily given from the Windsor Street works. He has reported that, of the mains included in the offer, about 5750 yards would have to be taken up, the Corporation having already mains in the same roads; but that of the larger mains so to be removed, about 700 yards would be immediately required to replace smaller mains elsewhere. The Committee thereupon offered the Sutton Gas Company £4500 for the distributing plant and goodwill; and this offer was accepted—the purchase to be completed, and the supply of gas transferred to the Corporation mains, on Sept. 30. At the request of the Corporation of Sutton Coldfield, the Committee agreed to supply gas to the public lamps in that borough on the reduced terms charged in the other districts within the area of supply, reserving to themselves the right to reconsider the terms should any considerable addition be made to the number of lamps in use.

LEICESTER CORPORATION GAS AND WATER SUPPLY.

The Half-Year's Accounts.

At the Meeting of the Leicester Town Council last Tuesday—the Mayor (Mr. Alderman T. Wright) in the chair—the half-yearly reports of the Gas and Water Committees were presented.

The Gas Committee reported that the accounts for the half year ending June 30 last showed that the net profit, after paying interest on capital, was £12,780. Out of this had been paid £3262, being the half-year's amount of sinking fund; and leaving a balance of £9518 to be applied at the end of the financial year (March 31 next) as the Council might direct. The net amount realized by the residual products was £7729; and the half-year's working of the gas-fitting business showed a net profit of £197. During the six months, 52,003 tons of coal had been carbonized. The quantity of gas made was 547,020,000 cubic feet, against 524,518,000 feet for the corresponding half of last year—an increase of 22,502,000 feet, or 4·29 per cent.

Alderman Lennard, in moving the adoption of the report, said that, in the corresponding period of last year, the profit was £14,936, or after a sum had been placed to the sinking fund, £12,174; so that in the past half year there was a total decrease of £2656. The last year or two they had been in the unfortunate position of being obliged to announce a smaller profit than usual; but he felt sure that this could be satisfactorily accounted for. Indeed, he thought the members of the Council might congratulate themselves that it had not been found necessary to advance the price of gas. The Committee had had to contend against great difficulties and adverse circumstances; and while they simply came before the Council with a decreased profit, the majority of corporation gas committees and companies had had to advance their prices, and others had to announce decreased profits of £20,000 and £30,000. Alderman Lennard then showed how the profits had been affected by the decrease in the prices obtained for residuals and other causes; and he incidentally mentioned, in speaking of the sale of chemicals, that large quantities of disinfectants had been exported by them to Russia. Altogether since the gas-works had been transferred to the Corporation, the amount of net profit had been £331,457. Of this amount, £236,278 had been applied to the relief of the district rate; and the remainder had been utilized for the purposes of the sinking fund, the reserve fund, and renewals.

The motion was carried.

Alderman Wood then presented the report of the Water Committee, which referred to the providing of an additional water supply, and the steps which had been taken to secure land at Swithland for the purpose. In moving its adoption, he said there was a net balance of profit of £5626, which was a slight increase upon the corresponding half of last year. The expenses had been pretty much the same. A sum of £642 had been taken out of revenue towards relaying the mains which existed under their sewage farm. It was thought very undesirable to allow these pipes to remain under the sewage farm for fear of a breakage occurring, and the water becoming contaminated. As a matter of interest, he mentioned that, since 1878, when the undertaking was taken over by the Corporation, they had made a profit of £108,330, of which £33,507 had been devoted to the capital debt. In regard to the extensions of the works, he said the Committee recommended that the works outside the Swithland Valley should be carried out under the supervision of their own Resident Engineer (Mr. F. Griffiths), and that Mr. Everard, a local engineer, be appointed for the works in the Swithland Valley. Replying to a question, he stated that the total cost of the works was to be £270,000; and they would be saving a large amount of commission by placing Mr. Griffiths in charge of the portion proposed.

The motion was carried.

THE ABANDONMENT OF THE CANNEL GAS SUPPLY TO LONDON.

[From the *Engineer*, Sept. 23, 1892.]

With the close of the present month, the supply of cannel gas to the Metropolis comes to an end. The event is one to be noticed, as indicating a change in the circumstances which affect the supply of gas to London, and in some degree to the kingdom generally. For many years past the supply of cannel gas in the Metropolis has been entirely in the hands of The Gaslight and Coke Company, known in former days as the Chartered, being originally established by Royal Charter in 1810. As late as 1869, part of the supply given by four of the London Gas Companies appears to have been cannel. But a fifth, called the Western Gaslight Company, set on foot in 1846, supplied us other gas than cannel from its commencement. The works of this Company were situated at Kensal Green; the area of distribution including Kensington, Brompton, and a singularly detached spot, extending from Conduit Street to Pall Mall, taking in St. James's Square. In 1869 the capital of the Western exceeded £400,000, being considerably larger than that of the South Metropolitan, and also greater than that of four other London Gas Companies. In the Midsummer of 1872, the Western was absorbed into The Gaslight and Coke Company; and its account for 1871 (its last complete year) shows a sale of gas to the extent of nearly 600 million cubic feet. The lighting power of the cannel gas was equal to 20 candles; while that of common gas was either 12 or 14 candles. The superiority of the cannel gas in its degree of illumination occasioned a peculiar crisis during the existence of the Western Company. The Vestry of St. George's, Hanover Square, felt aggrieved at having its domain illuminated by common gas, and demanded that The Gaslight and Coke Company should give them the benefit of the superior article. The old Company was not altogether disposed to make this special arrangement; but the St. George's Vestry threatened that, unless cannel gas was supplied, they would forthwith patronize the Western Company. Those were the days in which there was no "monopoly." London, in respect to gas, was open in every part to all the Companies; and a very considerable amount of confusion was the result. Pressed by the Vestry, and not desiring to see the Western Company coming into its district, The Gaslight and Coke Company undertook to supply cannel gas. As it was optional with the consumer whether he would have common or cannel gas, the Company had to duplicate its mains over a considerable area. But it happened otherwise in the immediate vicinity of Grosvenor Square. This locality had stoutly resisted the modern heresy of illumination by gas, and adhered heroically to the use of oil. It thereby came to pass that this part of London—as it then existed—was the last to accept gas; and as the surrender took place after the extension of the cannel supply, only one set of mains was laid down in that neighbourhood. But everybody does not like cannel gas; and in compliance with the wish of the Duke of Westminster, a special main was laid from Park Lane to his residence in Upper Grosvenor Street, in order that his Grace might enjoy the luxury of common gas instead of cannel. That the Duke was wise in his generation has been proved by recent events.

When the Western Company underwent amalgamation with The Gaslight and Coke Company, the question had to be solved whether the cannel supply should be continued throughout the area hitherto

appertaining to the Western. The people of Kensington gladly embraced the opportunity to take common gas instead of cannel. Still, the cannel supply was retained in several parts. Buckingham Palace and the Houses of Parliament have thus been lighted; and 3 per cent. of the entire supply sold by The Gaslight and Coke Company last year was cannel, a proportion which represents 557 millions of cubic feet. But how is it that London, after having more or less of a cannel gas supply for at least forty years, is now to go without it? The present era is one in which a high illuminating power appears to be especially popular. The electric light is in the field, pouring forth floods of brilliance. But people do not altogether care to have floods of light in their dwellings, or in their places of business, especially as payment has to be made *pro rata*. Sufficient, and not too much, represents the real demand; and it is evident that 16-candle gas at 3s. 1d. suits the public better than 20-candle gas at 3s. 10d. Such are the present rates under the sliding scale. The initial price is 4s. 9d. for cannel gas, and 3s. 9d. for the common. More than one reason may be assigned why common gas is preferred. The improvement effected in gas-burners has exercised a marked effect in developing the light-giving power of gas. There is little doubt that the common gas of the present day is giving a light equal to that imparted by cannel gas in former years, when the burners were of an inferior type compared with those now in vogue. The question of price also comes into play; and there is a natural tendency to accept the cheaper article. Another circumstance bearing on this question is the increasing use of gas for heating and cooking purposes. Gas to be used as fuel need not be of a high illuminating power. Cannel gas applied to the boiling of a kettle, the cooking of a joint, or the heating of a room, is an obvious absurdity, of which the Duke of Westminster must have been distinctly aware in the case we have already mentioned. On the whole, there is nothing surprising in the fact, as stated in the last half-yearly report of the Directors of The Gaslight and Coke Company, that "the proposed change has been received with general satisfaction in the district supplied with cannel gas." Proof of the preference has long been afforded by the circumstance that, where the duplicate mains exist, the consumers of cannel have frequently requested to have their supply changed for common gas. A transfer in the other direction appears to have been almost unknown.

While reasons such as the foregoing influence the public, there are others which affect the Company. In the nature of things, there is a check to the continuance of the cannel gas supply. The coal necessary for the production of this illuminant is itself becoming extinct. Torbane Hill, near Edinburgh, was worked out many years ago; and the genuine Boghead has disappeared as completely as the old Wallsend of the common coal. The appellation remains; but the special article to which it properly belongs is no longer in the market. We now have the Duke of Hamilton's Lesmahagow. This description of cannel is nearly gone, and sells at 58s. per ton delivered in the Thames. Next in order is Lord Lothian's cannel. Of this there is no great quantity; and it is not likely to last much longer. Scotch cannels of high-class are not only required for gas making, but are sought by the Scotch themselves for the purpose of oil distillation. The general result is the creation of a famine price for this particular kind of coal. But the discontinuance of cannel gas does not end the difficulty. Ordinary coal will not yield 16-candle gas. Hence, in order to comply with that standard, as established in the Metropolis, the gas produced from common coal has to be enriched by some admixture, obtained by the use of cannel coal or other suitable agent. The question thus presents itself, whether even 16-candle gas is to be maintained. This statutory minimum for London gas was prescribed in 1868, at the instance of the Corporation of the City and the Metropolitan Board of Works. These authorities, in appearing before the Select Committee of that year, strained every nerve to get the range of lighting power raised to this point; being nettled by an unlucky phrase which fell from the lips of Dr. Letheby at the close of his evidence. This eminent witness happened to say that "14-candle gas was good enough for London;" and this was interpreted as meaning that London merited nothing better, whereas the idea intended to be conveyed was simply that London needed no higher lighting power for its gas than 14 candles. The point for consideration now—more than it was in 1868—is, whether 14-candle gas, at a proportionate reduction in price compared with 16 candles, would not be a good bargain for the gas consumers of the Metropolis, seeing that the improved burners bring out a much higher lighting power than was formerly thought possible. Under the sliding scale, that which saves the Company benefits also the consumer; and there is reason to believe that 14 candle gas would rescue the gas companies from the dilemma arising out of the increasing scarcity and dearness of the better kind of cannel coal.

One way of escaping, or at least mitigating, the growing difficulty in supplying 16-candle gas, consists in adopting other means than the use of cannel for the enrichment of gas produced from common coal. During the last half year, when both common and cannel gas had to be supplied, The Gaslight and Coke Company carbonized rather more than 28,000 tons of cannel. But, in addition, the equivalent of 37,000 tons of cannel was used in the form of oil. With the oil gas thus obtained, there was, we believe, some admixture of water gas. The attempt to utilize oil was made some years ago, but has lately been carried on with greater success and to a large extent. Crude oil from Russia is employed for this purpose; and the process henceforth will serve to economize the use of cannel coal in the production of 16-candle gas. That a portion of the gas consumed in London should have a Russian origin is a little singular. But at one time it was thought possible to aid the gas manufacture in England by the use of Australian shale, which is even richer as a gas coal than the original Boghead. The idea was, that this coal could be brought over as ballast. But it proved too light in proportion to its bulk; and only a small quantity reaches this country, selling at 84s. per ton, at which price it is employed for making gas. While we have thus treated the question as it affects London, it is obvious that the growing scarcity of cannel coal concerns all gas companies which supply gas of high lighting power. The increasing use of gas for heating purposes, to which we have already alluded, cannot fail to influence the future history of this industry. Gas also takes its place as a motive power, in which form its illuminating property is entirely superfluous. Although gas is mainly in demand as a comparatively cheap and facile source of light, it would seem as if its illuminating power has been a little overdone, so as to call for fresh consideration. The disappearance of the cannel supply from the Metropolis is a suggestive incident; and common gas is itself undergoing a change in regard to its composition. Companies which are subject to the operation of the sliding scale have every reason to cheapen not only the manufacture of gas, but also the supply; and it cannot be truly said—as it was some years ago—that "gas companies are not disposed to make trial of any new processes which, if successful, would revolutionize their own manufacture." This was put forth as a reproach to the English gas companies, at a time when water gas was beginning to find favour in the United States. The sliding scale puts an end to any argument of this kind; and we may rest assured that any mode of making gas that will help the dividend, will be cordially welcomed by the London companies. The cheaper the supply, the better for the Company as well as the consumer; and the prospect of dear coal will stimulate invention.

GAS UNDERTAKINGS IN THE COLONIES.

We have lately received the reports of several Colonial Gas Companies; and we give below a few particulars in regard to the working of some of the principal undertakings:—

The report of the Australian Gaslight Association for the half year ending June 30 last shows that the profits during that period amounted to £51,747. At the meeting of proprietors at which the document was presented, dividends of 9s. and 6s. per share were declared for the half year. This absorbed £49,634; leaving a balance of £2113. The Engineer (Mr. T. J. Bush) reported that the whole of the Company's plant had been maintained in good condition.

The profit and loss account of the Brisbane Gas Company for the half year ending June 30 shows that the balance from the previous half year, after paying the dividends, amounts to £3713, and that during the past six months the receipts have amounted to £18,369. After meeting the various expenses, a balance remains of £12,087, from which the Directors recommend a dividend of 5½ per cent.

The business of the Latrobe Gas Company continues to be of a satisfactory nature, although, owing to the commercial depression that prevailed during the half year ending June 30 last, there has not been that increased consumption of gas which might have been anticipated. The amount to the credit of profit and loss (£135) is not so much as might have been looked for. But this, as the Directors explain in their report, is owing to the fact that this is the first time the balance-sheet has been made up for the half year; and a large item has been charged to working account for fittings and general sundries which properly belong to the whole year, but have been paid for out of the receipts for the six months, and which must increase the next half-year's balance. These things considered, the Directors recommend that the usual dividend be paid at the rate of 7 per cent. per annum. The quantity of coal carbonized during the half year was 86 tons; and the gas manufactured amounted to 828,500 cubic feet.

The half-yearly meeting of the Launceston (Tasmania) Gas Company was held on the 5th ult. The Directors reported that, during the last three months of the half year, the Company had felt the inevitable consequences of the present general commercial depression; the sales of gas having been less than for the corresponding period of the preceding year, though the number of consumers showed a satisfactory increase. With the steady growth of the business, it was evident, the Directors remarked, that provision must be made in the near future for the demands for an increased gas supply; and the preliminary work for building another gasholder had been commenced. But, in view of the temporary depression, it was considered safe and prudent to delay the proposed expenditure for another year; and the work had therefore been stopped for the present. An interim dividend of 6 per cent. was paid in February; and the balance to the credit of the profit and loss account was £4036. The Directors recommended that a dividend at the rate of 12 per cent. for the year be declared. The report also showed that the manufacturing operations had been very satisfactorily conducted under the direction of Mr. T. S. Cleminshaw, Assoc.M.Inst.C.E. The quantity of coal carbonized during the six months was 3009 tons of Newcastle and 118 tons of shale, from which gas was produced of an average illuminating power of 18·35 candles, as tested by the "London" standard No. 1 Argand burner. The amount of gas manufactured was 30,395,200 cubic feet, which was equal to 9718 feet per ton of coal carbonized. In moving the adoption of the report, the Chairman (the Hon. W. Hart) said there had been a slight falling off in the consumption of gas; but the consumers had increased from 2701 to 2802. With regard to the dividend of 12 per cent., some persons had remarked that this was too large; but he would like to point out that for several years the Company paid no dividend at all, and, when they did commence, the dividend was small. Some figures supplied to him by the Secretary (Mr. Arthur Green) showed that the consumption of gas in the half year to June 30, 1891, was 22,903,400 cubic feet; in the half year to Dec. 31 last, 27,334,700 feet; and in the past half year, 25,740,200 feet. The number of meters in use at June 30 last was 2802, which was an increase of 101. The report was unanimously adopted.

The Directors of the Metropolitan Gas Company of Melbourne informed the shareholders at their last half-yearly general meeting that the finances had suffered to the extent of £12,093 in the first six months of the present year, as compared with the corresponding period in 1891. The amount at the credit of the net revenue account, including £5000 transferred from the reserve fund, was £73,442, from which £72,649 was taken to pay a dividend of 9s. per share (18 per cent.); leaving £793 to be carried forward. The receipts from the sale of gas amounted to £217,205; the total revenue being £256,805. The expenditure amounted to £169,300 (coals costing £94,251)—a difference of £87,505. The quantity of coal and cannel carbonized in the past six months was 102,922 tons; the gas production being 1,007,329,000

cubic feet, of which 933,399,100 cubic feet were accounted for. The residuals made in the half year were: Coke, 59,042 tons; tar, 1,038,324 gallons; and sulphate of ammonia, 941 tons.

In presenting their 39th half-yearly report to the shareholders, the Directors of the Rockhampton (Queensland) Gas Company, Limited, expressed their pleasure at being able to announce the continued prosperity of the Company. Although the consumption of gas in the six months ending June 30 last was considerably less than in the corresponding period of 1891, the number of consumers had materially increased. This circumstance, the Directors remarked, was evidently due to the townspeople economizing in the matter of gas. The large extensions of gas-mains that have been recently made, tapping as they do new districts, will largely increase the consumption during the current half year. It is satisfactory to know that all the new extensions that have been made have paid well; and there are others of an equally remunerative nature to be proceeded with as soon as the Directors have arranged for the creation of fresh capital by the issue of debentures or shares. Another matter which has militated against the profits being maintained has been the very liberal discounts the Directors deemed it expedient to allow to consumers of gas, and particularly to those who use it as a fuel. Every effort is being made to bring gas into more universal use as a fuel; and the Directors feel sanguine that the course they are pursuing will ultimately prove highly advantageous to the Company as well as to the consumers. The profit for the half year was £1547, which, with the balance carried forward (£16), made the amount standing to the credit of the profit and loss account £1563. From this the Directors recommended the payment of a dividend at the rate of 10 per cent. per annum, amounting to £1498 9s. 2d. free of dividend tax, and carrying forward the balance. Since the shareholders last met, the work of installing the electric light by the Company has been proceeded with. The bulk of the plant has already arrived, and is in course of erection. Special care has been exercised in procuring the best and most improved description of dynamos, engines, boilers, and other important machinery; and the Directors are assured by the Electrical Engineer, upon whom they have had to depend for advice in all matters appertaining to the installation, that the light will be satisfactory and reliable in every respect. (It was expected that the electric current would be in operation by the end of August.) Debentures to the value of £10,000 were issued about two years ago, in anticipation of the capital required for this installation. It was afterwards considered advisable to devote part of it to the erection of a new gasholder, which had reduced the amount by upwards of £2000. Other enlargements in the gas-making plant have also encroached on the amount originally in hand; and it will therefore be necessary to issue more debentures or shares to keep pace with the further developments that will take place with both the gas and electric light. All the projected extensions, the Directors stated, promised a very good return upon the capital involved.

GAS AND ELECTRIC LIGHTING IN CHELSEA.

We have received a copy of the report of the Surveyor to the Chelsea Vestry (Mr. T. W. E. Higgens) dealing with the work of his department during the year ending March 25 last. The only portions which have any interest for our readers are those referring to the lighting of the streets by gas and the position of electric lighting in the district. With regard to the street lighting, it appears that there are 1448 public gas-lamps, of which 1385 are furnished with 4-feet burners; and, with the exception of four lamps, the remainder range from 24 feet down to 5 feet. Of the exceptions, one is a 150-candle lamp, one an 80-candle, and two are of 45-candle power. During the year, 208 defective lights were reported to the Gas Company's inspector; and of these 183 were caused by naphthalene and 25 by water in the service-pipes. There were 1159 defective lanterns and head irons reported and repaired; and 1380 regulators were tested. During the year twelve new lamps were fixed. The price charged for gas was 2s. 2d. per 1000 cubic feet; the cost per annum being for the 4-feet burners £1 13s. 9d., running up to £10 2s. 8d. for the 24-feet per hour. The expense of lighting was 15s. each lamp; omitting the 12 and 24 feet lamps, which cost respectively £1 and £1 15s. The lamps were lighted 3898 hours during the year. Turning to the remarks made on the subject of electric lighting, we learn that, at the beginning of the year, the Vestry had under consideration the St. Luke's (Chelsea) Electric Lighting Order, and decided to offer opposition thereto, although it was drawn up on the lines of the Board of Trade Model Order. The Board of Trade would not accept the amendments proposed by the Vestry. They then opposed the Bill in the House of Lords, and, in spite of the objections of the County Council, obtained the desired alterations so as to make the Vestry the Electrical Authority for the parish. At the end of July, the Vestry appointed the Surveyor an Inspector under the Electric Lighting Acts, so as to empower him to examine the records of pressure, &c., kept by the Electric Lighting Companies. The Cadogan Electric Lighting Company not having complied with their Act as regards a money deposit, the Board of Trade have not served them with the usual regulations as to safety and supply, so that the only Company keeping records which the Vestry's Inspector can examine is the Chelsea Electricity Supply Company. From time to time he has inspected their records, and finds that the pressure recorded by their instruments is always above 100 volts (it usually being about an average of 103 volts), except on one or two occasions, when alterations were being made to the engines. He considers that their system shows very satisfactory results; and is of opinion that they keep well within the limits laid down in the Board of Trade's regulations. The report also includes some figures as to the number of houses lighted by electricity in Chelsea. They are as follows:—

	1889-90	1890-91	1891-92
Chelsea Electricity Supply Company	113	215	312
Cadogan Electric Light Company ..	25	16	18
London Electric Supply Corporation	1	2	2
	139	233	332

It thus appears that about 100 houses have adopted electric lighting during each of the last two years.

EAST LONDON WATER-WORKS COMPANY.

The Half-Year's Working.

The report of the Directors and the accounts of this Company for the half year ending June 24 last disclose a very satisfactory state of affairs—there having been a substantial increase in the revenue and decrease in the expenditure, compared with the corresponding period of 1891. The revenue for the past half year was £141,157, against £137,387 in the June half of 1891; being an increase of £3770. The expenditure was £58,345, as against £60,542; being a decrease of £2196. The increase of revenue and the balance of profit transferred to dividend account is £77,811, which is in round figures £6000 more than for the June half of 1891. On capital account £17,662 has been expended—mainly in the extension of works at Lea Bridge, which have been noticed in previous reports. The three new triple expansion engines, the report states, are now fully in work, and are running most satisfactorily. During the half year moderate progress has been made in driving the tunnels from the Lea Bridge and Walthamstow wells. The yield of water so far has equalled expectation. Very good progress has been made in the sinking of the new well at Chingford; and it is expected that the chalk will be reached in a few weeks' time. Considerable improvements have been effected at the Lea Bridge works. The River Lea has been widened and straightened, and retaining walls erected. The quantity of water pumped was 8,085,661,949 gallons, against 8,312,788,783 gallons in the corresponding period of last year. The new services laid on numbered 2120, against 1627 last year—the total number now in supply being 172,583. Alluding to the Bills introduced into Parliament by the London County Council and the Corporation of London, the Directors mention that these were referred to a Committee (presided over by Sir Joseph Pease), who restricted the provisions to the expenditure of a sum not exceeding £10,000 for the purpose of making inquiries into the question of the water supply of London. Some information respecting the Royal Commission is next given in the report; its constitution and the terms of reference being quoted. The Water Companies, it is also remarked, have put in their respective statements which have been supported by their officers; the London County Council and other parties to the inquiry have also appeared. The geological evidence yet to be produced will, the Directors believe, demonstrate to the Royal Commission that the Thames and Lea watersheds contain an abundant supply of pure water available for the use of the Metropolis. It is seen from the accounts that a further payment has been made to the Chamberlain of London under the East London Water-Works Act of 1886. The amount, calculated as provided, was £1472; and this sum was applied "in purchasing and extinguishing" £738 of the ordinary stock of the Company, in accordance with the Act of Parliament. The Directors announce with deep regret the death of their colleague Captain Hugh Davis, whose family have been associated with the Company's management for many years. The report concludes with the recommendation that a dividend on the ordinary stock at the rate of 8 per cent. per annum (less income-tax) be declared. This will absorb £68,789; leaving an unappropriated balance of £8115.

THE NEW RESERVOIR OF THE BURY CORPORATION.

On the occasion of the meeting of the Incorporated Association of Municipal and County Engineers at Bury a few weeks ago, a visit was paid to the works in connection with the new reservoir at Clough Bottom, now in course of construction under the direction of Mr. J. Cartwright, M.Inst.C.E., the Borough Engineer and Surveyor There are, in all, eight reservoirs serving the Corporation's area of supply; their capacities, in cubic feet, being respectively as follows: Calf Hey, 22,500,000; Holden Wood, 14,410,000; Harden Clough, 2,240,000; Gin Hall, 7,000,000; Chesham, 1,500,000; Hampton, 56,000,000; Clarke's Hill, 1,240,000; and Clough Bottom, 28,800,000—making a total, in round numbers, of 130,000,000 cubic feet, or about 810,000,000 gallons. In the course of the proceedings at the meeting, Mr. Cartwright read a paper in which he furnished the following particulars as to the new reservoir: The Bill authorizing its construction was passed in August, 1889, and the works were commenced in May, 1891. The top bank is at an elevation of 1015 feet above Ordnance datum. The natural drainage area is 421 acres; and it is augmented by an area of 315 acres brought in by a catchwater drain about a mile in length. The mean annual rainfall is 35 inches; and deducting 14 inches for evaporation, there is an available fall of 21 inches for the purposes of the reservoir. The compensation water amounts to 540,000 gallons per day of 12 hours. The area of the top water is 32 acres, and the capacity of the reservoir is 202 million gallons, allowing an available supply of 25 gallons per day for 175 days for 30,000 consumers. The main embankment contains some 217,000 cubic yards, has a maximum height of 76 feet, and a maximum width of 490 feet, with an area of 6¼ acres, and is 20 feet wide at the top. The internal slope is covered with pitching varying in thickness from 12 inches at the top to 9 inches at a vertical depth of 35 feet below, laid on shingling. The external slope from the top bank to the first benching is 2 to 1; from the first to the second benching, 2½ to 1; and from the second benching to the toe of the bank, 3 to 1. It is drained throughout with earthenware pipes. The puddle wall is 7 feet wide at the top, and batters outwards 1 in 12 on each side till reaching the natural surface of the ground, when it is sloped inwards until it reaches a maximum width of 12 feet, at which width the trench is carried down. Where the puddle is less than 12 feet in width, reaching the natural surface of the ground, the trench is carried at such less width. The puddle wall is backed on each side by fine material 20 feet wide at its top, and battering outwards 1 in 4. The total length on the top of the bank is 165 feet, and a road 12 feet wide and a footpath 3 feet wide are carried across and over the bye-wash by a bridge 12 feet wide and 20 feet span, and connected to the diverted highway. A storm-wall 4 ft. 6 in. in height, and curved to meet the pitching, is carried across the bank. The water from the reservoir is conveyed through the embankment by means of a

tunnel 496 feet in length, driven for almost the entire length in the solid. Its internal diameter is 5 ft. 6 in.; and it is built of three rings of brickwork—the innermost being blue brick, surrounded by 12 inches of lime concrete from the inlet bay to the shaft, and from the shaft to the outlet bay by 12 inches of cement concrete. It is curved at each end to a radius of 90 feet, and goes in a straight line through the puddle trench, where it is supported on a concrete block carried down to the bottom of the trench. Where the inlet tunnel joins the shaft, the diameter is increased to allow of the construction of the stop-piece, which is built of brickwork in cement 6 feet thick, and through which two cast-iron pipes are carried—one 30 inches diameter to relieve the reservoir, and one 15 inches diameter for the supply; the latter being carried to the mouth of the tunnel before being driven through its side and into the solid. The compensation water can be delivered from either of the pipes as occasion may require. The valve-shaft is built entirely in cement, and is 11 feet square for a height of 14 feet from the bottom, and is there corbelled into a diameter of 8 feet, at which it is carried up to the level of the top of the bank, a further height of 57 feet. With the exception of the radial work in the tunnels, the whole of the shaft is constructed of masonry and concrete; and built into the walls of the shaft are two draw-off pipes, one 20 feet and the other 40 feet below top water, together with the girders necessary for the support of the valves. These are in duplicate for each draw-off; the other valve in each case being worked by capstans from the top of the shaft, and the inner ones kept in reserve. The valve-shaft will be approached from the bank by a lattice girder steel foot-bridge of 50 feet span, resting on a masonry pin on the bank. The pipe-line from the reservoir to Rawtenstall, the point of junction with the existing mains of the Corporation, will be 8980 yards long, and will weigh 1600 tons. The pipes are to be of the ordinary spigot and socket kind; and their internal diameter will range up to 14¼ inches.

INCORPORATED ASSOCIATION OF MUNICIPAL AND COUNTY ENGINEERS.

At the Meeting of the members of the Irish district of the Incorporated Association of Municipal and County Engineers, which was held at Belfast on the 23rd and 24th ult., papers were read by Mr. J. C. Bretland, M.Inst.C.E., on the "Progress of Municipal Affairs in Belfast," and by Mr. W. J. Robinson, Assoc.M.Inst.C.E., on "Londonderry, with some Notes on Its Engineering and Sanitary Progress."

Belfast Corporation Gas and Water Supply.

The only portion of Mr. Bretland's paper which has any interest for our readers is a brief reference to the gas and water works of Belfast. He says the gas-works were purchased by the Corporation in 1874, since which time the price of the gas has been reduced by the Corporation from 4s. 6d. to 2s. 9d. per 1000 cubic feet. The profits have been yearly very large; and last year they amounted to £34,462. At the present time, there is urgent need for large extensions of the plant; and the Corporation are now engaged in selecting a site for additional works. As to the water supply of the city and neighbourhood, this is under the control of the Belfast City and District Water Commissioners—a separate corporation, the members of which are elected by the ratepayers. Large sums of money have been expended in grappling with the constantly-increasing demand for water; and at the present time a scheme is being prepared for obtaining an Act of Parliament next session for an additional supply from the neighbourhood of the Mourne Mountains—some thirty miles or so distant.

The Lighting and Water Supply of Londonderry.

Among other topics relating to the engineering and sanitary progress of Londonderry, Mr. Robinson dealt with the lighting and water supply. It appears from his remarks that the lighting of the city with gas was started in the year 1830, and has proved a very great success to the shareholders of the Company. In a number of the leading streets, Sugg's patent lamps have been erected; each one of these costing as much as five ordinary lamps. The present cost of ordinary lamps is £3 5s. per annum; and the charge for gas 3s. 10d. per 1000 cubic feet. Last year the Corporation obtained a Provisional Order to light the city with electricity, which at present is in course of being carried out. On the subject of the water supply, Mr. Robinson has more to say. The first public water supply, he states, was obtained by the construction of a small reservoir on the hill above Waterside, on the south-east side of the city. This was made to hold 4 million gallons; and the water was conveyed from it into the city—a distance of rather more than a mile—by means of oak pipes, having a 6-inch bore, and some of them are still in use. The estimated cost of these works was £8000; but, through mismanagement in conducting them, the actual cost was £15,583. The entire ground taken up by this reservoir was only 1 acre and 27 perches. In 1852 a scheme was put forward for constructing works on the north-west side of the city. A reservoir was made capable of holding 10 million gallons, and which at that time was considered of great magnitude. But the futility of stopping at a half measure was discovered before the works were completed; and additional powers were obtained to construct a second reservoir in the same valley capable of holding 70 million gallons—the quantity sent into the city daily being about 300,000 gallons. This was the full capacity and supply up till 1873, when it became evident that it was quite inadequate. As a temporary measure, the banks of the reservoirs were raised so as to increase the capacity about 10 million gallons; however, the peace obtained from those who clamoured for more water was short-lived. Agitation was set on foot, and various schemes were suggested. The Corporation took the opinion of some eminent engineers; but eventually they fixed upon a plan put forward by the author, which was examined, approved, and reported upon by Mr. L. L. Macassey, C.E., of Belfast, by whose advice, as Consulting Engineer, the works were constructed. These include three reservoirs on the north-west side of the city, capable of containing 150 million gallons of water, and on the south-west side two reservoirs, having a capacity of 40 million gallons. At present there is a supply of 30 gallons per head per day; and, by a small outlay, the intake of water to these reservoirs can be doubly augmented. Previous to 1887, there was no provision for the filtration of the water. Connected with the works then in operation, and which affected the lower levels of the city, there was constructed a large straining-well fitted with double copper-wire screens, with crushed cinders placed between; and the percolation of the water through these has rendered it much brighter and most effectual in lessening the albuminoid ammonia. The upper, or higher part of the city, which was supplied from a different service, has been provided with a filter-bed formed of cinders, sand, and gravel. A part of the district thus supplied stands higher than the filter-beds; but this has been obviated by creating a pressure of 50 feet by means of a pair of pumps, driven by a direct-acting motor, which is in turn actuated by the inflow of the water to the filter-bed. This motor is of the "Duncan" meter pattern; and it has now been in operation two years, and found to work well. The amount expended in water-works during the past seven years has been upwards of £35,000. The water is analyzed each quarter by the City Analyst, and generally is reported by him to be very satisfactory.

THE CONGRESS OF THE SANITARY INSTITUTE.

Reference has already been made in the JOURNAL to the congress of the Sanitary Institute recently held at Portsmouth under the presidency of Sir C. CAMERON; and we purpose now to record briefly a few of the more interesting matters, from our readers' point of view, which came under consideration.

The subject selected by the President for his Inaugural Address was "The Victorian Era, the Age of Sanitation." He remarked that, before the Victorian era, there were few sanitary laws worth administering, and consequently no *raison d'être* for local boards or officers of health. Some drainage works were carried out by the town and county authorities; and a few attempts were made to improve the water supplies of urban districts. The filth produced in towns had to be got rid of in some way. On the other hand, people were taught to be too economical in the combustion of fuel by the imposition of a rate on hearths; and they were encouraged to exclude daylight by having to pay a window-tax. The insanitary state of British towns was made painfully evident by the invasion of cholera in 1831-2, when there died therefrom 31,376 persons in England and Wales, and 21,171 in Ireland. In 1848 it reappeared in England and Wales, and destroyed 53,273 lives. In 1853 there were 20,097 deaths ascribed to cholera, of which about one-half occurred in London. In 1866 it reappeared, but with less fatal results. The deaths in England attributed to it were 14,378; in Ireland, 2501; and in Scotland, 1470—total, 18,149. This lessened mortality, in his opinion, was not due to the milder character of the disease, but rather to the towns being less filthy than they were during the previous visitations. A Committee appointed to inquire into the sanitary condition of the Metropolis reported in 1848 that no substantial improvement had taken place in the state of the back streets, lanes, alleys, and courts since the cholera epidemic of 1831-2. They expressed an opinion that, if the disease were again to visit London, it would spread as extensively and prove as fatal as it did in the former visitation. This prediction was unfortunately but too soon verified; but in the meantime the era of sanitary activity was initiated by the passing of the Public Health Act of 1848. This Act, though it permitted and did not compel sanitary reforms, was a useful one, and was availed of to some extent, as was also the case with the Local Government Act of 1858. The powers conferred upon health authorities, at first almost invariably permissive, gradually became more of a mandatory character. Proceeding to consider the results of sanitary work, the President referred to the large sums of money which have been spent in carrying it out; and he asked: "Have the results of this vast expenditure of money and human labour been such as to satisfy us that it has not been a waste of our pecuniary resources and our time? Do they encourage us to further outlay and increased exertions?" He thought both queries might be answered affirmatively. That money spent to improve the sanitary condition of places has not always been judiciously laid out, was, he said, quite true; but the same might be said of the expenditure for most other public purposes. It must, moreover, be admitted that the provisions of many of the Acts relating to health had not been fully carried out; and that many local sanitary authorities, especially in rural districts, had lamentably failed to perform the duties, whether permissive or mandatory, entrusted to them by Parliament. There were hundreds of towns and villages in the British Islands which were still unprovided with proper arrangements for drainage and filth disposal, and which were dependent upon scanty supplies of water, often of bad or inferior quality. On the whole, however, it must be admitted that the sanitary powers confided to the local authorities had been largely put in force. Sir Charles next compared the present sanitary state and death-rate of the United Kingdom with those of the last and the early part of the present century; and he showed how the frightful mortality of London and other cities in the last century was due to neglect of sanitation. Coming down to more recent times, he stated that it was certain that the mere expectation of a life—*i.e.*, the probable duration of a life at birth—had been largely increased within the last 25 years. Vital and moral statistics were next dealt with; and the means of further reducing the death-rate were touched upon. To soil-pollution the President attributed the prevalence of typhoid fever; and as a preventive against the disease, we must, he said, keep the underground air from entering our dwellings. We should be as particular with respect to the purity of the soils under and close to our dwellings as we are with regard to the purity of the air which surrounds us. When all the organic *débris* produced in towns is quickly removed from them to a safe distance, and when the dangerous subterranean atmosphere is prevented from entering our dwellings or even our streets, when sewage flows steadily day and night through well-constructed main sewers, and when our soils are thoroughly drained and kept free from filth, then we may expect to see a substantial reduction in the mortality

caused by typhoid fever and, indeed, by other diseases. The closing portion of the address was devoted to the subject of improving the dwellings of the poor.

The second day of the congress was taken up by conferences of municipal and county engineers, sanitary inspectors, medical officers of health, and naval, military, and domestic hygienists; and on the following day the work of the Sections began. In the Section devoted to "Engineering and Architecture," the President (Mr. J. Lemon, M.Inst.C.E., F.R.I.B.A.) delivered a very interesting address. He said sanitary engineering might be called a modern science, as it was only since the passing of the Towns Improvement Act of 1847 and the Public Health Act of 1848 that serious attention had been given to the subject. Investigations were made into the causes of zymotic diseases in towns; and it was found that want of efficient sewerage, defective house drainage, pollution of wells, badly-constructed dwellings, and want of ventilation, were among the main causes of high death-rates. He discussed the principles to be kept in view as regards town sewerage, especially as to the rainfall and the gradient of the sewers. He said rainfall ought to be dealt with according to local circumstances. There were advantages attending the separation of the rainfall from the sewers, especially where it was necessary to treat the sewage chemically or to dispose of it on land; but if by a separate system a duplicate system of drains to every house was meant, this was not, in his judgment, either practicable or desirable. With regard to the ventilation of sewers, he said that, after 40 years' experience, he had come to the conclusion that an open sewer down the centre of a street, with a good fall, would be the best form of construction. This, however, was impracticable; and he therefore said, "Get as near to it as you can." He concluded by enumerating the various points on which a sanitary architect should insist in carrying out his work. "The Pollution of Rivers and Canals by Manufacturing and Industrial Operations" was the subject of a paper contributed by Mr. W. Hepworth Collins, of Bolton. The author contended that there was no reasonable cause why every manufacturer should not be compelled to treat the polluted water upon his own premises. Possibly the most effective and economical way of dealing with the enormous volume of pollution from manufacturing sources was by concentration and by evaporation followed by condensation. The Section resolved that it was desirable that local authorities should have enlarged powers to compel manufacturers to cleanse the rivers into which their waste products ran; and if they did not do so, to carry out the work, and charge the manufacturers with the cost.

The purification and supply of water were dealt with in several papers. Mr. W. Whitaker, as already mentioned in the JOURNAL, gave a description of a number of maps showing the area of chalk available for water supply in the central and eastern parts of the London basin. He dwelt chiefly upon divisions showing the tracts of bare chalk, chalk covered by permeable beds, chalk protected by beds of mixed or of varying character, and chalk protected by impermeable beds; and he observed that the making of these maps had been extended of late—four sheets having been done, or partly done, for the special use of the Royal Commission on the Metropolitan Water Supply. He also read a paper on "Local Geology from the Sanitary Standpoint." In the discussion which followed, Dr. Russell touched upon the importance of pure water to all communities, and on the fact that had been made clear by Mr. Whitaker's maps and his papers that the water held in the chalk—that big sponge, so to speak—was the purest and best source of supply for domestic purposes. Mr. H. Law asked how far the existence of chalk affected the water supply. Mr. Whitaker had, he said, told them the circumstances which affected the entry of water into the chalk; but there was another important question concerning its escape therefrom. In many parts of the valley of the Thames, enormous volumes of chalk water might be seen running to waste. In an investigation which he carried on for two years in connection with one of the Metropolitan Water Companies, the object being to obtain a supply of water from the chalk, he found it escaping at the mean level of the tide from Hammersmith to Brentford; and at Erith the same thing might be seen. Dr. Newsholme, of Brighton, asked if Mr. Whitaker had seen an article in the *British Medical Journal*, stating that, in consequence of water taken from the ground north-east of London, the whole landscape was altering and tree-growth diminishing, and saying that the limit of the water supply was nearly reached, so that London would have to go to a greater distance for its water. Would there, he asked, be a sufficient supply in the South Downs without detriment to the local supply there? Mr. Washington Lyon asked whether London might not obtain a sufficient supply from the chalk beds beneath it. Mr. Whitaker, in reply, said the question of the escape of water was a difficult one to deal with. Speaking of the abundance of water in the chalk, he mentioned the case of Brighton, where, in making a sewer, they accidentally tapped a spring, and were nearly flooded with fresh water. In some places near the sea, they could sink wells and get good water; in others, a mile away from the sea, the wells would only yield salt water. This was noticed in some parts of Essex; and in another instance, a well sunk in the chalk having given only salt water, the bottom level was raised, and they were now getting good water from the upper part of the chalk. As regarded the alleged change in the condition of the country from which water was taken, he thought they would want a very powerful magnifying-glass to see it, so infinitesimal was it. There was certainly a large supply of water in the South Downs, and a great deal ran to waste, which might be taken without disadvantage to anyone. As to the water beneath London, he thought they would fail to get a sufficient supply by sinking wells. They might sink 200 wells, and only find one of them successful.

In another paper, Mr. Whitaker showed how the water supplies for Portsmouth and Gosport are obtained. In the case of the former town, the water is drawn from the chalk; whereas the supply for the latter comes from strata of clay and sand. The author described the Gosport Water-Works as an excellent example of the way in which every distinct bed of sand was made to contribute to the water supply all the way down. He said he had been struck by the ingenious manner in which, by means of a large well or reservoir, they were able to store a day's supply before they commenced pumping. Portsmouth obtained its water with the minimum of trouble; indeed, he had never seen a more simple or easy piece of work. The chalk from which it came was at the junction of the tertiary beds; and he was not sure that there was not some mixture in the water—not that this was any disadvantage, for it made it somewhat softer than it otherwise might be. The works were near Havant, which stood on a gravel flat full of water. The water obtained from gravel strata, through which sewerage percolated, might be deleterious to health; and he urged the Portsmouth people to take every precaution to prevent contamination from Havant. Mr. J. H. Ball asked for information with regard to the various springs to be found in the neighbourhood of Havant; and he bore testimony to the great care the officials of the Portsmouth Water-Works Company took to prevent any contamination of the supply. The Engineer of the Company (Mr. H. R. Smith, Assoc.M.Inst.C.E.) and other gentlemen having spoken, Mr. Whitaker, in reply to Mr. Ball, said the springs referred to were but the repetition in another place of those from which the Water Company obtained their supply; but they were at a higher level in the valleys of the chalk hills. They were known under a great many names; and he asked Mr. Ball, or anyone else, to record the times of the outbreak of the springs, and as to the water-level of the wells in their vicinity. Mr. Baldwin Latham had, he said, taken such careful observations that he was able to predict on what day, and where, these streams would break out. He urged that no water ought to be obtained in towns except from companies.

Mr. H. Law, M.Inst.C.E., read a paper descriptive of an apparatus for softening water. He said the *rationale* of the process consisted in adding to the water certain substances which reacted upon the foreign matters already contained in the water, forming new compounds, which, being no longer soluble, might be removed either by filtration or precipitation. The largest installation he knew of was at Southampton. Mr. Whitaker said that at Southampton they reduced the hardness of the water from 18° to 8°, using as little lime-water as possible. In the North of England, it had been found that they were getting their water too soft. Water that was too soft was not wanted. The trouble was to get rid of the deposit. There was an opportunity for inventors to find a profitable use for a new waste product. He hastened to say at once they could not make whiting of the lime residuum. The cost at Southampton was ¼d. per 1000 gallons—say, for a million, the professional guinea; while at Bedford, a smaller town, it cost nearly ½d. per 1000 gallons. At Southampton they used the softened water for the higher purposes, and the other for the drains and street-watering.

Dr. Horace Swete read a paper giving details of a process for purifying the waters of the Severn at Worcester by means of metallic iron. There are three purifiers, capable of dealing with 1,700,000 gallons of water per day; and they have been put down on certain conditions—the Revolving Purifier Company undertaking, during a period of six months' working, to adequately purify the very foul water of the Severn, which, before reaching Worcester, has received the sewage and refuse of fourteen towns. It is an application of the principle of the spongy-iron filter, with a modification suggested to Dr. Anderson by Sir F. Abel after the spongy-iron process had failed for the water-works of Antwerp in 1884. The suggestion was that, if the spongy iron could be kept in motion in the water to be filtered, it might be more successful; and on this idea Dr. Anderson designed his revolving purifier, the apparatus now on trial by the city of Worcester. The undertaking given is to remove from the water all colour; to get rid of the organic matter to the extent of 50 per cent. at least; and to reduce the microbes to Dr. Koch's limit for pure water of 100 microbe colonies per cubic centimetre. The author explained the process in detail; but it may be briefly described thus: It is chemical, so far as the formation of the oxides of iron are concerned, and the reduction of some of the carbonaceous organic matter. It is after that mechanical; reducing the pores of the filter, and enabling them to undertake what they could not perform before, especially with peaty and clayey waters. Dr. Swete said, in conclusion, that he thought, when a supply of deep-well water could not be obtained, the result of the experiment at Worcester showed there is a process which may render river or brook water sufficiently good to come within the category of potable waters.

Other papers, which do not call for special notice, were discussed; and the congress closed with the usual popular lecture.

More Work with the Divining-Rod.—In the JOURNAL last week we recorded, on the authority of certain published statements, another instance of the skill possessed by Mr. John Mullins in the use of the divining-rod in searching for water. We learn from our Edinburgh Correspondent that this "occult method of arriving at concrete facts" has lately been employed by two Haddingtonshire proprietors (Sir T. Hepburn, of Harperdean, and Mr. Nisbet-Hamilton-Ogilvy, of Biel); the operator being again Mr. Mullins. The process was the usual one; and it must be acknowledged that on both estates the "diviner" was able to satisfy the company who had assembled to see him at work that he could do what he professed. He was first asked, on the Harperdean Estate, to point out the location of a hidden spring from which one of the farms is supplied with water. This he very soon did; and thereby at once put himself on good terms with the previously sceptical spectators. He was then set to work in earnest; and he indicated several places where water could be found, in one of which, he said, nearly 4000 gallons per hour could be procured. This information has, we learn, been the occasion of considerable excitement in Haddington, where the Police Commissioners are almost at their wits' end where to turn for an addition to their water supply. This quantity would, it seems, be sufficient for them, and would be a cheap scheme compared with any they have yet considered. On this estate, it may be mentioned, the farmers have suffered greatly from want of water; and borings have been put down at various places in search of it. They have, however, all been unsuccessful; and Mr. Mullins was only called in as a last resort. The day after the trial above referred to, he was taken to Biel, and, as a preliminary test, he was asked to trace the course of a water-pipe which crosses the lawn. This he again effectually did. He was afterwards conducted over the estate, and pointed out a number of places where, he said, water could be found. Of course, his "findings" of water have yet to be verified; but he has, at least, succeeded in satisfying his employers that he possesses the gift of divining.

THE POLLUTION AND PURIFICATION OF RIVERS.

At the recent Meeting of the Incorporated Association of Municipal and County Engineers at Bury, a paper on the above subject was read by Mr. H. A. ROECHLING, Assoc.M.Inst.C.E., of which the principal portions are given below.

England is rightly looked upon as having taken the lead in the question of practical sanitation; but it is equally true, on the other hand, that it is from England whence the outcry about the pollution of streams and rivers arose. There is no town or village that is not confronted with the solution of this complex problem, which presents a somewhat new aspect in every case; and it was in connection with proceedings against his Town Council for the pollution of the River Soar at Leicester that the author was for the first time brought face to face with what was in that case an embarrassing problem.

The question of the pollution of our rivers is by no means a modern one, and does not date from the introduction of the system of water carriage of all fæcal matters. It is well-known that in all parts of the globe the rivers and streams were looked upon for centuries as the medium for conveying away the filth and refuse of which communities wished to get rid. No doubt as long as the population on the banks of a river remained small, this did not cause a serious pollution; but when the towns increased in size and population, the nuisance such a course entailed grew more and more serious, till at last it became an absolute necessity to take all the refuse and filth out of the river and provide other channels for it. This was the commencement of the systematic drainage of towns, which was intended to prevent the pollution of the subsoil of houses and streets, and to keep the rivers and streams within the town free from polluting influences. It cannot be denied that, by the introduction of a proper and well maintained system of sewers and drains for carrying away all refuse water and fæcal matter, the first object has been attained—viz., the keeping of the subsoil clean; but as to the second object, the author is afraid that it has not been achieved in all cases. There are towns which purify their sewage, and which cause no pollution in the stream that takes the effluent; but there are others which cause serious pollution. It does not follow, however, that the first set of towns spend more money on sewage purification and purify their sewage to a higher degree than the second set; the sole cause in the difference of results being in some cases the river into which the effluent goes. Some rivers seem to be able to deal successfully with any amount of sewage; others seem to turn sick at the smallest dose. There are other causes of pollution besides town sewage, such as the waste liquids from mills, factories, mines, &c.; but, as they are not of such general importance, they will not be here considered. It is this different behaviour of the rivers that it is the author's intention to investigate, and to throw, if possible, some light upon what has been called the self-purifying power of a stream. For this purpose he does not intend to confine himself to English rivers only, but proposes to review American, French, and German rivers as well, so as to give a complete survey of the present state of our knowledge of this question.

It will, of course, be admitted that no town has a right to keep its subsoil clean by a system of drainage, and to dispose of its filth to the disadvantage of perhaps smaller communities lower down the stream by polluting it. But, on the other hand, it will equally be admitted that a town has a right, after effective treatment, to turn the effluent from its sewage works or sewage farm into the river on the bank of which it is situated. The degree of effectiveness of such treatment must be the state of the river after it has received the effluent. If the river is turned into a black boiling mass of putrefaction by the effluent, the purification of the sewage is said to be a failure; but if it is left sweet and pure after proper admixture, we look upon the treatment of the sewage as successful. It is the river that decides the degree of purification which must be attained by the sewage treatment; and in this respect any well-considered scheme of sewage disposal or sewage utilization must start from the purifying powers of the river into which the sewage effluent is to go. The author is afraid this point has been overlooked in a good many cases, and rivers have been called upon to do work for which they were utterly unfit; hence their pollution. It may not be possible in all cases to preserve the river water below large towns in the state of purity it possesses near its source; but it is absolutely necessary to prevent its systematic pollution, be it by the effluent from sewage works, or by the waste liquids from mills, factories, &c. In this respect the author cannot but think that it is a wise course to tap rivers near their source for the supply of large towns, and not to rely on river water (as is the case in London) that has swallowed the sewage of a population of something like a million residing in 202 towns and villages.

Previous to 1866, this question had not received official attention; and it was left to chemists such as the late Dr. Letheby to study it in connection with sewage-disposal works. In that year, however, owing to the complaints about the bad condition of some rivers becoming louder and louder, a Royal Commission was appointed to investigate the cause of river pollution, and to suggest remedies. It issued two valuable reports, and was succeeded in 1868 by a second Rivers Pollution Commission, which sat until 1874, and issued six lengthy reports. Since then the subject has been repeatedly studied, both at home and abroad. Notable among these investigations are those made by the Massachusetts State Board of Health, on the rivers within their territory; by the French Commission of 1874, on the Seine at Paris; by Brunner and Emmerich (1874-5), and also by Prausnitz (1887-8-9), on the Isar at Munich; by Hulwa (1877-81), on the Oder at Breslau; by Frank (1886-7), on the Spree at Berlin; by Celli and Scala (1890), on the Tiber at Rome. The late Dr. C. Meymott Tidy also went very fully into the question, and read two elaborate papers thereon in 1880 and 1881 before the Chemical Society.

In order to give some idea of the composition of town sewage, the author prepared a table in which he compared the sewage of several European towns. In another, the sewage of water-closet towns and midden towns was compared; and there was not much difference between them. This was done to disprove what is sometimes asserted—viz., that the whole difficulty of sewage purification would be practically non-existent were the fæcal matters kept out of the sewers, and only the waste water from houses and the rain water carried away in them. A third table gave some analyses of waste liquids from mills and factories, from which it could be seen that these wastes are far more powerful sources of pollution than ordinary town sewage. The influence towns exert upon a river that flows through them could be learnt from another table. In the case of Bradford, for instance, the beck below the town contained in 1869 more than ten times as much ammonia and organic carbon as it did above the town, and nearly five times as much organic nitrogen. In Leicester, too, the Soar below the town was, in August, 1884, seriously polluted, though not to the same extent as the Bradford beck. Other tables prepared by the author contained analyses of the principal rivers of England, Germany, and North America, as well as of the Seine. In reference thereto, he said that some of the rivers dealt with have tidal portions; and he explained that in the investigations for his paper these parts were not included. The reason of this was not far to seek; the conditions in the non-tidal being so different from those in the tidal portions that it was impossible to group them in one set of investigations and arrive at combined conclusions. As the consideration of a non-tidal river is of far more general importance than that of a tidal one, the author only dealt with the former class of rivers; leaving the examination of rivers that are tidal for a future occasion. He said it was not possible in all cases to give particulars concerning the velocity and discharge of the river under review; and he expressed regret that sometimes elaborate analyses of a river at various points of its course were given without any attempt to convey some idea as to its discharge at these places, and as to the quantity of sewage poured into it. No definite conclusions could, he said, be arrived at without a full knowledge of these factors.

Proceeding with his paper, the author said: To judge of the condition of any river, it is usual to note its state as it appears to the naked eye, and to take samples of the water for chemical, microscopical, and lately also for biological examination. In the incipient stages of pollution, it is difficult sometimes to detect it with the naked eye; but when it has advanced further, the turbidity of the water, its colour, and smell are sure indications of it. The chemical examination should be carried out as soon as possible after the samples have been collected, otherwise further changes in the water will take place, and it cannot be said to express the various degrees of pollution so clearly as the biological one, which gives the number of germs per cubic centimetre. This is shown very clearly from the analyses of the water of the Spree at Berlin, and of the Nebel near Guestrow. In the case of the Spree, for instance, the amount of oxygen consumed lies between 1·69 and 2·30 parts per 100,000 parts; whereas the number of germs discovered ranges between 6141 and 329,905 per cubic centimetre. In this country it has not been customary up to the present time to examine water biologically; but on the Continent and in America this analysis now generally accompanies the chemical one.

The late Dr. Letheby stated before the Royal Commission on Water Supply in 1869 that he had made a very great number of chemical experiments to determine the self-purifying powers of rivers and streams. He had also examined most of the rivers in England; and the conclusion he had come to was this: If ordinary sewage, containing (say) nearly 100 grains of solid matter per gallon, such as the London sewage, out of which probably something like 14 or 15 grains were organic, were mixed with twenty times its bulk of ordinary river water, there would, after a flow of a dozen miles, be not a particle of that sewage discovered by any chemical process. The late Dr. Tidy, who was at one time assistant to Dr. Letheby, held very similar opinions; and, in a paper read before the Chemical Society, he stated that, if sewage were discharged into running water, the organic impurities would, after a flow of a few miles, be entirely destroyed or got rid of—the water once again assuming its normal condition of purity. He was of opinion that this power of self-purification depended on the subsidence of the suspended matters, on the presence of animal life in the river, and on the oxidation of the organic matter. The second Rivers Pollution Commission, after having investigated the cases of the Irwell, Mersey, and Darwen, which were at the time the examination was made highly-polluted streams, and the case of the Thames, and after having made some laboratory experiments, came to conclusions somewhat opposed to those held by the late Drs. Letheby and Tidy; for whereas these two gentlemen were of opinion that the suspended impurities and the dissolved organic matter were completely removed after a certain length of flow—the former by subsidence, the latter by oxidation—the Commission held that, though the flow of a river had a most material influence in the removal by subsidence of a large proportion of the suspended impurities both organic and mineral, especially if the flow was sluggish in places, the oxidation of the organic matter proceeded with extreme slowness even when the sewage was mixed with a large volume of unpolluted water, and that it was impossible to say how far such water must flow before the sewage matter became thoroughly oxidized. In fact, it would be safe to say that there was no river in the United Kingdom long enough to effect the destruction of sewage by oxidation. On the Continent of Europe, the opinions on this question are very similarly divided. It was the author's privilege to take part last year in the deliberations of the German Association for the Promotion of Public Health; and he had the pleasure to listen to a long argument by the veteran German sanitarian, Professor Von Pettenkofer, in favour of the total annihilation of sewage in river water when the quantity of water in the river was never less than fifteen times that of the sewage, and the velocity of the former at least equal to that of the latter. The Prussian Government, and that of several of the minor States, appears to have been guided at first by considerations proceeding from views similar to those expressed by the Rivers Pollution Commission; but latterly a change of opinion in this respect is noticeable, and more weight is attached to the opinion of Professor Von Pettenkofer.

It cannot, of course, be denied that almost any river, some miles below the point where it has received polluting liquids, looks fairly clarified again—the distance in each case depending mainly on the degree of dilution; but it does not follow by any means that the river has purified itself during this length of run. All those who are endeavouring to purify sewage, either by artificial or natural means,

will know that there is practically not much difficulty in getting rid of the suspended matters, and that the main difficulty lies in the removal of the dissolved organic pollution. Of course, there can be no such thing as self-purification if the organic pollution remains in the river; and it is with reference to this point that opinions differ so materially.

The author said he would not attempt to give in full his examination into the rivers in various countries of which analyses were given in the appendix to his paper. It would be sufficient to say that the whole of the rivers were examined, and due consideration given to each case; and that the following conclusions were arrived at: (1) That rivers possess self-purifying powers. (2) That these powers are, in the main, limited to the sedimentation of the suspended matters and germs. (3) That though rivers do possess the power to oxidize the organic matter in them, yet, owing to this power being small, the process is a slow one. (4) That the distance over which the process of self-purification goes on depends chiefly on the velocity of the river and the quantity of water flowing in it (degree of dilution). He then proceeded as follows: These conclusions should not be taken as final, as there is undoubtedly a great deal of further information required before this subject can be considered to have been exhausted. It is necessary that all the public bodies charged with the care of our rivers and streams should make complete examinations of the rivers, &c., within their district, somewhat after the manner followed by the Massachusetts State Board of Health. Such examination should extend over a period of twelve months at least, and should comprise, beside careful chemical and biological examinations of both the water in the river at different points of its course, and the sewage and waste liquids which it receives, exhaustive inquiry into the drainage area of the river, its geological formation, its rainfall, its population, the velocity and the discharge of the river at the points selected throughout the year, and the amount of polluting liquids poured into it. Such investigations will at the same time afford valuable information concerning the question of the water supply to towns. In this respect the present Royal Commission on the Water Supply of the Metropolis is collecting valuable information concerning the Thames.

The conclusions at which the author has arrived lie somewhat midway between those expressed by the Rivers Pollution Commission and by the late Dr. Letheby. There are undoubtedly rivers which purify the sewage within a very short distance, and there are others where the river cannot right itself for miles. The former is the case where the degree of dilution is a very high one—*i.e.*, where the quantity of sewage is only a very small fraction of the flow in the river; the latter is the case where the sewage does not become much diluted by the river water. But wherever a river receives more sewage than it can deal with, it almost loses its power of self-purification.

Professor Von Pettenkofer proposes that the city of Munich should use the River Isar experimentally as a sewage farm. The drainage scheme for Munich was designed by the late Mr. Joseph Gordon in such a manner that the sewage, if required, could be applied on land without the aid of pumping. It is now proposed to establish a few "roughing" filters near the river, in order to take out all floating matter, and then to let the raw sewage go into the Isar. If it can be proved at any time, he says, that such a course is fraught with danger to the river and the communities lower down its course, the present outfall can be used as a storm overflow, and the sewage treated on land. The population of Munich now amounts to 285,000; and when completely sewered, the maximum flow of sewage will amount to about 35 cubic feet per second. The discharge of the Isar at low water is about 1400 cubic feet per second, and its velocity at this time 4 feet per second. In this instance the sewage amounts to 2·5 per cent. of the flow in the river at low water; and Professor Pettenkofer, after having investigated the case thoroughly, is sanguine that no pollution will ensue in this particular case. It is quite impossible, in the present state of our knowledge, to lay down a general rule as to the degree of dilution which marks the boundary between the permissible and the non-permissible quantity of sewage. This will have to be ascertained for each river in particular—the conditions varying in each case. It has already been stated that Professor Von Pettenkofer is of opinion that, if the sewage does never amount to more than 1-15th, or 6·7 per cent., of the river water, and if the velocity of the latter is at least equal to that of the former, raw sewage may be poured into such river without causing pollution.

In America, Mr. J. P. Stearns, Engineer to the Massachusetts State Board of Health, who has written a very able report on this subject, came to conclusions from which the author has deduced the following: If the sewage amounts to more than 1-40th, or 2·5 per cent., of the quantity of river water, it cannot be discharged into the river in its raw state; if it amounts to less than 1-40th, and more than 1-130th, or 0·8 per cent., it is doubtful whether it may be admitted; but when it amounts to less than 1-130th of the river water, it may be admitted without any doubt in its raw state. Stearns adds that these considerations are made from the "standpoint of the offensiveness of the water." From other standpoints, however—such as the use of water for certain manufacturing purposes—the amount of dilution should be greater, and in a stream used for domestic water supply, it cannot be said, with our present knowledge, that any degree of dilution will make the water entirely safe for use.

In this country the results obtained from the discharge of raw sewage into the rivers have been very disastrous; the population of our towns being large, and the flow in the rivers small, compared with the Continent and North America. After much careful consideration, the late Commission on the Metropolitan Sewage Discharge came to the conclusion that in England it was not safe to turn even the effluent from chemical works into a running stream which did not carry twenty times more water than sewage.

The question of keeping our rivers pure and sweet is one fraught with many difficulties, which ever increase from year to year; and those who are responsible for their state have by no means an easy task both in this country and abroad. As this is, in the author's opinion an international question, he has thought it might be of interest to have, besides information from home, some from other parts of the globe bearing upon it.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

There was a good deal of business before the Edinburgh and Leith Gas Commission last Monday, the chief item of which was that which dealt with the price and quality of the gas. This subject was brought up in the report of the Works Committee, who had previously considered it in conjunction with a report by Mr. J. S. Gibb, the Treasurer, upon the probable net cost of gas of two different qualities. In his report, the Treasurer stated that he had had the benefit of written statements by the Engineers as to the likely cost of their special departments, and that he assumed that the amount of gas sold would be the same as last year. His calculations were that, per 1000 cubic feet of gas, the charges would be, for coal, manufacturing, distribution, and repairs and maintenance, to produce gas of from 24 to 26 candles, 28·82d.; and to produce gas of from 25 to 27 candles, 29·96d. Capital and other charges would add 13·01d. to each of these; and the total charge would be 41·83d. for the former, and 42·97d. for the latter. Adding unaccounted-for gas, he estimated that the lower quality gas could be produced for 46·22d., and the higher quality for 47·48d. per 1000 cubic feet. In the Committee, Bailie Archibald moved that the lower quality should be adopted, and that the price should be 3s. 10d. per 1000 cubic feet—the reduction to take effect from October. Mr. John Jamieson moved that the higher quality should be adopted. When it came before the Commission, Bailie Archibald again moved the same motion. He pointed out to them that the price of the first-class cannel which had been tendered was higher by 2s. or 3s. per ton than what they were paying under their existing contracts; and that, were they going into the market now for a whole year's supply, they would not have been able to fix the price they proposed. Then, unless the price of that coal was reduced, when next Whitsunday came they would require to again raise the price of gas. Further, his proposal was sailing so near to the wind—it was ¼d. per 1000 cubic feet under prime cost—that he did not think it would be wise or safe to go closer, particularly as there might be a further fall in the price of residuals. He was willing, however, to compromise with those who were opposed to him, and to insert in his motion that the quality of the gas should be from 25 to 26 candles. Mr. Wells, in seconding, thought it was not proper to fix the illuminating power of the gas; but that they should provide the coal, and say to the Engineer that he was to make the best gas he could out of it. Then came the counter-motion, which, in the Commission, was proposed by Mr. Kinloch Anderson. It was on the right lines, had it been supported by facts or argument; but neither Mr. Anderson nor his seconder put forward either, and all they did was to waste the time of the Commission or to play to the gallery. Their proposal was the very simple one that they should reduce the price of gas to 3s. 10d., but that the illuminating power should be retained at its present standard of from 25 to 27 candles. Both gentlemen looked at the matter from the rather primitive point of view that they had extracted too much from the pockets of the public last year, and that they should return part of the overcharge. They are evidently unaware of the disadvantages of oscillation in price. Another plea Mr. Anderson put forward was, that they had extra charges last year to the amount of £11,000 which would not recur; but all support for his proposal from that point was dissipated by Bailie Archibald eliciting from the Treasurer that he had taken those extra charges into account in making up his estimate. Mr. John Jamieson, in seconding, made a statement which is surely outside of possibility, when he said that "every Commissioner was satisfied that they could supply first-class gas without buying any of that high-class coal at all." I can only account for his remark by supposing that what he meant by "first-class gas" was gas without impurity, and that he did not refer to illuminating power at all. After a good deal of discussion, Bailie Archibald's motion was adopted by a majority. Gas consumers in Edinburgh will therefore experience great relief, in the matter of cost, in such a large reduction as 8d. per 1000 cubic feet; and I have no doubt that the majority of them will experience no depreciation in the amount of light they will receive.

Concurrently with the reduction in the price and quality of the gas, the Commissioners have fixed their coal contracts till Whitsunday. Their purchases for the Edinburgh works amount to 82,000 tons, in which are included 28 varieties of coal, ranging in price from 25s. to 8s. 3d. per ton—the average being 14s. 1d. per ton. For the Leith works, the purchases amount to 30,000 tons, which include eleven varieties, ranging in price from 18s. 4d. to 8s. 6d.—the average being 14s. 1¼d. per ton. These are very considerable reductions. In June last, 5500 tons of third and fourth classes of coal were purchased for the Edinburgh works at an average price of 12s. 2d. per ton. The comparison should, however, be made with the purchases in April, 1891, for the whole of last year. These were, for the Edinburgh works, of an average price of 20s. 8¾d.; and for the Leith works, 20s. 9¾d. per ton. The reductions are, therefore, for Edinburgh, 6s. 1¾d.; and for Leith, 6s. 8¼d. per ton. This result is effected by leaving out the Lesmahagow, Armiston, Newbattle, Rosewell, and other first-class coals, which should be an instructive object-lesson to the owners of those coals.

Mr. Wells brought forward his motion with respect to the works, to which I referred last week. It was, as I expected, a double-barrelled proposal, dealing both with the erection of an experimental station and new works. It is the experimental station which is his first consideration. His notion apparently is that, when acquiring ground for it, sufficient should be taken for the whole works, to be used when required. On the experimental station he talked sensibly, pointing out the puzzle which it had been to them when they got different analyses of the same coal, which is a thing that has troubled more than Mr. Wells. He wants a practical experimental station to get rid of that. It would be a somewhat costly institution, if worked upon thoroughly exhaustive rules; and to me it is a question whether any savings which might be realized in the purchases of coal would not be eaten up in the experiments, which would lead to the question being as broad as it is long. Strange to say, Mr. Wells had support for the second part of his motion in a quarter I should have never looked for it. Mr. Kinloch Anderson is of opinion that the erection of new works

would pay; because, by the introduction of modern appliances, the Commissioners would save about 1s. per ton upon the coal carbonized, and he works out that sum, capitalized, at £220,000. As Mr. Wells merely asked a remit for inquiry, this was agreed to.

It was reported to the Commissioners that the assessors for Edinburgh, Leith, and Mid-Lothian had fixed the valuation of the Commissioners' undertaking at £76,686—an increase upon last year's valuation of £25,166. Bailie Steel, in ignorance of the method adopted in the assessment of gas-works, wanted to know how there was such a great increase; and he was informed that it was on account of the large profit which was made last year.

A deputation of members of the Manchester Corporation visited Glasgow this week for the purpose of getting information as to the gas and electric lighting undertakings which the Scottish Corporation have under their charge. The visitors included Mayor Leech. They were shown the City Chambers in the evening, lighted by electricity; and were instructed in all that has been done in connection with the public electric lighting installation. On the forenoon of the next day (Wednesday), they were driven to the Dalmarnock gas-works of the Corporation; and the same day they returned to Manchester. Mr. W. Foulis, the Gas Engineer to the Glasgow Corporation, accompanied them, as did also the Convener of the Gas Committee, on the occasion of their visit to the gas-works. The visitors were shown the latest appliances for use in gas manufacture in Glasgow, and left for home delighted with what they had learned and seen. The electric lighting station in Waterloo Street is rapidly approaching completion; and it is expected that private consumers will be supplied with the light not later than Dec. 1. The public lighting arrangements are not in such a forward state; but the mains are being laid, and the expectation is that by Jan. 1 some of the streets in the central district will be lighted by electricity. It was stated at the Glasgow Police Commission meeting on Monday that the Lighting Committee had erected 600 additional gas-lamps in thoroughfares in the suburban districts, and that more were required; but that, on account of the cost, the work had been left over for a time. These will more than compensate for the public lamps in the central district which are to be superseded by the electric light.

The Eyemouth Gas Company propose, with a view to increasing their gas consumption, to reduce the price from 8s. 4d. to 6s 8d. per 1000 cubic feet—a sweeping reduction of 1s. 8d., which is the largest I have ever heard proposed.

The condition of the Aberdeen water supply has, from time to time within the past few years, been mentioned in this column as being a source of anxiety to the city authorities, on account of the very serious pollution of its source. It is wholly derived from the River Dee, which is the receptacle of the sewage from all the villages and a large number of mansion houses in its course of more than 50 miles. Conferences have recently been held between the city authorities and the County Council, with a view to measures being taken to remove the cause of the complaint by the city. These may possibly be successful to an extent; but that entire immunity from pollution is not likely to be attained was shown in the remark of Colonel Innes, the Chairman of a County Council District Committee, last Saturday. "It was hardly possible," he said, "to satisfy the authorities in the city with the water supply. The experts were entirely at variance on the subject of what the possible effect of any pollution at a high point of the river would be. It was said, on the one hand, that if a germ got into the river at Braemar, it would find its way down to Aberdeen; and on the other, that all that was required to prevent this was to make the water pass through an irrigation field, while other experts declared that an irrigation field would make no difference." In view of the ravages of cholera in Continental cities whose water supply is taken from contaminated sources, this is very poor comfort for the citizens of Aberdeen. There is abundance of water; and the conditions as to gravitation in the district are simply magnificent. It is therefore worthy of the attention of the Town Council, whether they should not adopt one or other of the loch schemes which have been proposed. Though more expensive to begin with, they might be found to be cheaper in the end.

The Spalding Water Company and the South Lincolnshire Fen Water Scheme.—The annual meeting of the Spalding Water Company took place last Thursday. A dividend at the rate of 7 per cent. was proposed (absorbing nearly £1000); and it was also recommended to transfer £200 to the reserve account, and carry forward a small balance. In reference to the South Lincolnshire Fen water scheme (a Company having been formed to acquire the Spalding works and supply the southern part of the county with good water from a spring), the report said that the Company had failed to complete their contract for the purchase of the undertaking, though they had been pressed to do so; and the Directors now proposed that steps should be taken with the object of having the contract carried out without any further delay, or else cancelled. The report was adopted, after some little discussion.

West Gloucestershire Water Company.—At the half-yearly meeting of this Company, last Saturday week, the report submitted by the Chairman (Mr. S. Horton) stated that, during the six months ending Sept. 3, 1892, there were 479 additional services laid on; making the number of houses and other property supplied by the Company at that date 3669, estimated with miscellaneous supplies to produce a water-rental of £2973 per annum. The total estimated income at that date was £3023—an increase of £311 during the half year; and the Company were as yet only supplying about one-half of the houses within service distance of the mains. The Directors had placed the whole of the £15,000 of debenture capital authorized under the Act of 1884 on 4 per cent. preferential debenture stock. With the proceeds they had, in accordance with the intention expressed in their last report, purchased the freehold estate of Frampton Cotterell, upon which the springs and pumping-station and other property are situated, and also redeemed the 5 per cent. mortgage debentures. The balance of £1000 had been expended in carrying out the extension of mains. The report was unanimously adopted.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 1.

Sulphate of Ammonia.—The spot and September requirements having been filled, the tone of the market to-day is somewhat quieter, and buyers evidently anticipate that they will be able to buy cheaper this month. At any rate, both consumers and dealers have withdrawn from the market at present; but in view of the strong position of this commodity, it is unlikely that there will be much depreciation in values, even should buyers hold off for a week or two. Beyond this period they will hardly be able to stand off, as consumers as well as dealers are depleted of stocks. Quotations remain at £10 2s. 6d. to £10 5s. Nitrate is rather better in tone.

LONDON, *Oct.* 1.

Tar Products.—The principal feature in this market is the excellent demand for pitch, which not only maintained its value, but looks as if it would shortly be dearer. There is very little inquiry for benzol, toluol, or solvent naphtha, and the prices of them remain stationary. More is being done in creosote; but its value remained low, and not more than it is worth for fuel purposes. A large business is being effected in carbolic acid in its various forms, although the prices now prevailing are less than the quotations of a month ago. Makers and merchants have a good deal to say about anthracene; but little or no business is being transacted, as distillers will not accept the low prices offered by buyers, who are said to be well stocked and quite indifferent. In the meantime, it is reported that some of the dye manufacturers are restricting the output, in consequence of the serious falling off in the consumption. Business has been done at the following prices: Tar, 9s. to 10s. Pitch, 27s. Benzol, 90's, 1s. 7½d.; 50's, 1s. 3½d. Toluol, 1s. 1½d. Solvent naphtha, 1s. 1½d. Crude benzol naphtha, 30 per cent., 7d. Creosote, 1½d. Creosote salts, 20s. Pressed naphthalene, 40s. Carbolic acid, 60's, 1s. 7½d.; 70's, 1s. 10d.; crystals, 6½d. Cresol, 1s. 8d. Anthracene, 30 per cent., "A" quality, 9d.; "B" quality, 6½d.

Sulphate of Ammonia.—There is considerable activity in this market. The price continues firm, with a tendency to be better. Large shipments are being made, and important inquiries have come in for forward delivery. Sales have been effected at £10 2s. 6d. to £10 5s., less 3½ per cent. Gas liquor (10-oz.) is 6s. to 7s. per ton.

COAL TRADE REPORTS.

Lancashire Coal Trade.—The demand generally throughout this district still shows no appreciable improvement, except that house-fire qualities are moving off more freely; but for these there is no pressing demand, and beyond some hardening up where sellers have been previously taking under list rates, there is no quotable change in prices. Collieries also, with few exceptions, are barely working five days per week; and in many cases, stocks continue to accumulate. Common round coals remain more or less a drug upon the market, both for inland requirements and for shipment, with extremely low figures quoted to effect sales in anything like quantities. At the pit mouth, ordinary steam and forge coals do not average, for inland sale, more than about 7s. 6d. per ton; whilst for shipment, steam coal delivered at the Garston Docks or the High Level, Liverpool, is readily obtainable at 8s. 6d. per ton. With regard to engine classes of fuel, although prices are still fairly steady, there are more plentiful supplies; and large users are holding back in the expectation of lower prices. The threatened strike in the cotton trade, with the increased supplies which will necessarily come upon the market as the winter demand for house-fire coal increases, of course tends to weaken the position; and a meeting of Lancashire coalowners was held during last week, with a view of coming to some general understanding as to the basis on which tenders should be sent in for the large contracts usually placed with the Associated Salt and Chemical Manufacturers in the neighbourhood. Last year, contracts for large supplies were secured at exceptionally low figures; and the Lancashire coalowners seem anxious to protect themselves by some sort of combination against any undue competition with regard to the contracts for the ensuing year's supplies. Best qualities of burgy do not average more than 6s. to 6s. 3d.; best descriptions of slack, 5s. to 5s. 3d.; medium, 4s. to 4s. 3d.; and common, 3s. 3d. to 3s. 6d. per ton; and at these figures a want of firmness is beginning to show itself on the part of sellers.

Northern Coal Trade.—The coal trade of the North is decidedly weaker; and there has been a strong tendency towards lower prices. In steam coals, this was to have been expected, as the time is now near when the shipments to the Baltic fall off rapidly. The collieries are now working off some of their orders; and they are willing to accept rather lower prices for forward delivery. For early shipment, however, best Northumbrian coals are still 10s. to 10s. 3d. per ton f.o.b.; second qualities being 9d. to 1s. per ton lower. Small steam coals are very abundant; and are obtainable at from 3s. 6d. to 4s. per ton, according to quality. For bunker coals, as low as 6s. 10½d. per ton has been accepted—the supply being very large; and from the price named for unscreened, it ranges up to 9s. 6d. for the best Durham screened. For gas coals, the demand is now advancing satisfactorily but there is an ample supply as yet for all requirements, and though the demand will now increase with some rapidity for nearly three months, yet there will soon be reduced exports to the Northern Baltic ports. The price of gas coal is very irregular. One of the large producers in Durham is so far well contracted for, that he can ask from 8s. 6d. to 9s. for odd cargoes; but this is the exception, and generally speaking the price for good qualities may be said to range from 7s. 6d. to 8s. 3d. per ton f.o.b. Should there be a large additional demand, however, the price for odd cargoes would speedily and sharply advance. Coal for manufacturing purposes is quiet; and users will only make forward contracts at a reduction. Coke for blast-furnaces is firm; and commands 13s. to 13s. 6d. per ton at the local furnaces, or from 15s. to 16s. per ton for export. There is little or no

alteration in the price of gas coke for the last few days; but the production increases.

Scotch Coal Trade.—The past week was one of sudden development. Almost like a thunderbolt came the announcement that the coalmasters in the West of Scotland had met, and had resolved that, from the 6th inst., the wages of the miners should be reduced by 6d. per day. The reduction is in some quarters looked upon as only half what it should have been. It is only 2d. per ton; and it is difficult to see how so small a reduction could bring much benefit to the coal-owner. Such is the view of the miners, who have arranged for a "national conference" of delegates to be held in Glasgow on the above-named day, to consider the situation. In Fifeshire the men have not yet carried into effect their proposal to publish the names of non-unionists. They have given them time to consider whether they should join the Unions or not; and their proposal now is that if, by a certain date, a number of the men in any pit should be found not to have joined, the unionists will be taken out from that pit on strike. This proposal has been considered by the Fife, Clackmannan, and Kinross coalmasters; and their reply is that, while they will take no action as to the publication of the names of non-unionists, if a strike is originated at any pit they will at once proclaim a general lock-out. Commercially the trade position is exactly the same as it has been for several weeks. New orders, either home or foreign, are not coming in, and the trade which is being done is in the working off of old orders. Foreign competition, chiefly in the Westphalian and Calais districts, is expected to restrict shipping orders, which will, in turn, reflect upon prices at home. In the market, prices have not varied perceptibly. Main is quoted at 6s. 10d. per ton; ell, at 8s.; splint, at 7s. 6d. to 7s. 9d.; and steam, at 9s 6d. to 9s. 9d. Shipments during the past week amounted to 159,773 tons, which was a decrease of 15,207 tons on the preceding six days, but an increase of 21,469 tons as compared with the corresponding week of last year. For the year to date, the total shipments have been 5,548,224 tons—an increase of 680,869 tons over the same period of last year.

New Water Supply for Frodsham.—Frodsham, a small town near Warrington, is to have a new water supply. The first sod of the intended works was cut last week.

San Paulo Gas Company, Limited.—The report of this Company for the six months ended June 30 last shows that the net trading profit amounted to £13,157; but as this has been, for the purpose of comparison, taken at the exchange of 21d. per milreis, the reduction to the rate of 12d., added to the depreciation of assets in San Paulo from 13d., the rate at which these were taken on Dec. 31, 1891, causes this sum to be reduced to £3377, which the Directors suggest should be carried forward.

The Rating of the Vyrnwy Water-Works.—The New Town and Llanidloes Board of Guardians have called the attention of the Montgomery County Council to the fact that, although the Llanwyddn Water-Works of the Liverpool Corporation are rated for poor-law purposes, they are not rated for county purposes, and consequently the county derives no benefit from property assessed at about £20,000. The reason for the omission is that the present county rate is levied upon an old assessment return which does not include Lake Vyrnwy.

Electric Lighting for Scarborough.—According to a report submitted at a special meeting of the Scarborough Town Council last Friday, a company is to be formed to take over the powers granted to the Corporation by their Electric Lighting Order of 1891. The Corporation are to have the option of acquiring the undertaking at the end of twenty-one years, upon paying for it as a going concern. The maximum price of current to the Corporation for public lamps is fixed at 6d. per unit, and it is to be reduced at the rate of ¼d. per unit for each 1 per cent. per annum on the dividend declared above 8 per cent. per annum. The maximum price of current to private consumers is to be 7d. per unit.

The Increase in the Price of Preston Gas.—Last Friday the Mayor of Preston received a deputation from the Preston Trades Council and the Friendly Societies' Council on the subject of the increase in the price of gas—a matter to which reference has already been made in these columns. The Mayor stated that he had received a reply to his communication to the Gas Company; and it appeared that the Directors had held a special meeting on the question, but they could not see their way to alter their decision with regard to the proposed increase. The deputation then asked the Mayor to call a public meeting, which he consented to do, and promised that he would preside. The meeting, it is understood, will be held on the 10th inst.

Cookery Lectures in the North.—During the past ten days, Mrs. A. B. Marshall, of the Mortimer Street, W., School of Cookery, has been entertaining the ladies of the northern provinces with her practical lecture entitled "A Tempting Repast," consisting of some sixteen to twenty high-class dishes prepared and cooked by gas in the short space of two hours. Commencing on Monday, Sept. 19, at St. George's Hall, Liverpool, she visited in rapid succession Manchester, Leeds, York, Newcastle-on-Tyne, Edinburgh, Dundee, and Aberdeen; and everywhere met with large and appreciative audiences. The gas-stoves used were supplied by Messrs. Richmond and Co., Limited, of Warrington and London, who arranged a small exhibit of their appliances to accompany Mrs. Marshall.

The Water Supply in the Wakefield Rural Sanitary Authority's District.—The ratepayers of Sharlston met last Thursday to consider a proposal by the Wakefield Rural Sanitary Authority to apply for a Provisional Order for the compulsory purchase of land for the construction of water service reservoirs for the townships of Warmfield, Crofton, and Sharlston. It appears that some years ago the Authority agreed to supply the township for the sum of £900; but recently the main has been tapped to supply other townships—thus depriving Sharlston of a proper supply. It was also stated that, were a larger main laid, it would not remedy matters, as the pressure at Wakefield was insufficient. Hence, the necessity for the reservoirs. Resolutions were passed calling upon the Sanitary Authority to adhere to their original agreement with the township, and protesting against a reservoir being constructed at the cost of the township.

Additional Stock for the Maidstone Gas Company.—A special meeting of the Maidstone Gas Company was held last Thursday, under the presidency of Mr. Ambrose Warde (Chairman), when it was resolved to sanction the raising of £2000 additional stock by auction, and one-fourth of this amount on mortgage.

Ironbridge Gaslight Company, Limited.—A Company has been formed, under the above title, with a capital of £9000, in 450 preference shares of £5 each, and 900 ordinary shares of £7 10s. each to acquire the undertaking of the Ironbridge Gaslight Company, Limited, in accordance with an agreement of which particulars are given in the Company's Articles of Association, and generally to carry on the business of a gas company.

The Birmingham Corporation and the Gas Supply of Sutton Coldfield.—Reference is made, in the report of the Gas Committee of the Birmingham Corporation which appears in another column, to the completion of the purchase of the distributing plant and goodwill of the Sutton Coldfield Gas Company by the Corporation. In accordance with the arrangement come to between the two bodies, the property was taken over last Friday, and the necessary connections with the mains made.

A Gas Stoker's Claim for Wages.—A stoker named Bell brought a claim against the Morecambe Gas Company for £3 3s., being 14 days' wages in lieu of notice. Bell's case was that he was ill, and unable to go to work. When he recovered, he was told that he was not wanted. For the defence it was said that Bell was not discharged, but was offered work as a labourer at 5d. per hour, which was one of the things to which he had agreed in the event of his services not being required as stoker. The Lancaster Justices, before whom the case was tried, held, however, that the man was entitled to notice; and they gave a verdict for the amount claimed.

Tavistock Gas Company—At the annual meeting of the Tavistock Gas Company last Tuesday, it was reported that the net rental for private consumption for the year ended June 30 last amounted to £1774, and for public lamps to £473. On account of the favourable terms on which the supply of coals for the ensuing year had been obtained, the Directors were able to make a further concession to consumers in the price of gas from 3s. 6d. to 3s. 3d. net per 1000 cubic feet. From the statement of accounts, it appeared that £560, equivalent to 14s. per share, had been paid to the shareholders during the year; and the Directors recommended the payment of an interim dividend of 8s. The report was adopted.

New Water-Works for Bodmin.—Last Friday week, a meeting of the shareholders of the Bodmin Water Company was held for the purpose of considering suggestions for increasing the present supply. Betterwell is the source from which the Company now draw their water; but, during long spells of dry weather, the obtainable quantity is insufficient, while the situation necessitates a large outlay on pumping. It has been ascertained that an abundant supply of good water can be procured from a point some seven miles or so from Bodmin, in the St. Breward parish. To carry out all the necessary work of this scheme, £9000 would be required; but inasmuch as the County Lunatic Asylum at Bodmin is largely dependent upon the Water Company, and would benefit considerably by the scheme, the Cornwall County Council have agreed, under certain conditions, to bear part of the outlay. The shareholders empowered the Directors to take the necessary steps for raising the money by preference shares and debentures.

Electric Lighting Provisional Orders.—In a report just published, the Permanent Secretary to the Board of Trade (Mr. H. G. Calcraft) states that during the year 1891-2, 32 Electric Lighting Orders were applied for. Of these applications, 17 originated from local authorities, 14 from companies, and 1 from a firm of electrical engineers; 11 related to the Metropolis. Last year the total number of applications was 70, of which 37 were made by local authorities and 33 by companies—12 applications relating to London. Altogether, 24 Orders were granted, and the confirming Bills subsequently received the Royal Assent. Of the Orders granted, 17 were to local authorities and 7 to companies. Since the last report, three applications for Licences have been received; and these are under consideration. Appended to the report is a list of the Orders confirmed by Parliament prior to the past session, and of the Licences granted by the Board of Trade, since the passing of the Electric Lighting Act, 1882; showing those which have since been revoked or repealed. From this list it appears that, including the Orders contained in the present report, 116 local authorities and 60 companies possess electric lighting powers.

New Water Supply for Swinton, near Rotherham.—At a meeting of the Swinton Local Board, last Friday, the Surveyor (Mr. Monson) presented a report stating that the time had now arrived when some means of further water supply for the district should be considered. Over 100 houses had been, or were soon about to be, connected to the mains, and an application had been received from the M.S. and L. Railway Company for 100,000 gallons per day; but the supply was only equal to the present demand. He had carefully examined all the springs and taken into consideration the geological features of the district surrounding the Oaks Rock, from whence the present water was obtained; and he proposed that borings be made, in order to test the water-bearing strata, in two places—(1) at the site of the proposed high-level reservoir; (2) at a field near Bow Broom, belonging to Earl Fitzwilliam. Only two other sources were apparently available; but, in his opinion, neither was suitable for domestic purposes. One was the water pumped from Messrs. Charlesworth's colliery at Warren Vale, which yielded 104,800 gallons per diem. This was not sufficient for future requirements, and was largely charged with solid matter, a fourth of which was common salt. The other was the spring in a field near Warren Vale, which yielded 864,000 gallons per diem. This was also insufficient, and was contaminated with surface drainage and impregnated with iron. The Chairman said the sooner the matter was dealt with the better; it was impossible to pump continuously owing to scarcity of water. They needed information as to the further supply; and he was in favour of estimates being procured. It was eventually resolved that a special meeting should be held to consider the matter.

Newcastle and Gateshead Gas Company.—At an extraordinary meeting of this Company last Wednesday, the Directors were authorized to borrow £12,500, at 3½ per cent. interest. The money is required for improvements and extensions at the works.

The Electric Lighting Installation at Dublin.—The test of the new electric lighting plant at Dublin having been completed to the satisfaction of the Corporation, the Electric Lighting Committee, last Friday week, formally took possession of the works from Messrs. R. Hammond and Co., the sub-contractors. We understand that the gas-lamps in the streets where the arc lights are fixed have not since been lighted.

Sales of Shares.—Messrs. Cronk have recently sold by auction at Sevenoaks, 47 original £10 "A" shares in the *Sevenoaks Gas Company*, at £23 10s. per share; 18 "B" shares, £10, fully paid, at £16 10s.; and 62 £10 "B" shares, £8 paid, at £13.——At a recent sale, three £5 shares in the *Brompton, Chatham, &c., Water Company* fetched £14 12s. 6d. each.——Last Saturday week, 29 shares in the *Bodmin Water Company* were sold locally at prices ranging from £9 to £12 15s. apiece.——At a sale of various securities at Nottingham last Friday, £3 10s. annuities of the *Nottingham Corporation Water Department* sold at £103 5s., and £1 7s. annuities at £40 10s.

The Chatham Corporation and the Local Water Undertaking.—At the meeting of the Chatham Corporation last Wednesday, the Committee to whom a few weeks ago was referred the question of the proposed acquisition of the undertaking of the Brompton, Chatham, Gillingham, &c., Water Company, recommended that an Act of Parliament should be applied for to enable the Corporation to carry out the purchase, for which about £200,000 will be required. The history of the Company was laid before the members in an interesting speech by the Mayor (Mr. C. T. Smith), who concluded by moving—"That the Committee be empowered to act as may be necessary for the purchase of the water-works." Mr. Batchelor seconded the motion, which, after some adverse remarks, was carried.

A Serious Gas Explosion at the Loughborough Gas-Works.—An explosion, which, it is stated, was heard almost over the whole town, and which created a great deal of alarm in the immediate neighbourhood, occurred at the Loughborough Gas-Works last Wednesday morning. It appears that some men had been engaged in cleaning an exhauster; and they had only just recommenced work after breakfast when a rush of gas came through the dismantled exhauster, and, without any previous warning, exploded. There were in the building, which is used both as an engine and exhauster house, the engine-driver (John Kelley), William Hopkins, Alfred Lockwood, and Frederick Bradshaw; the last three being employed by Mr. Clements, an engineer. They were all thrown to the ground and momentarily enveloped in flames; while the doorway and surrounding woodwork, together with the adjoining window panes, were blown out. When removed from the house, it was found that all the men were more or less severely burnt on the hands, arms, and face; and all were removed to the hospital, where Kelley and Bradshaw were detained, both having sustained serious injuries. In an interview with a newspaper representative, the Manager of the Company (Mr. J. B. Ball) states that they were making alterations to the exhauster, and had it taken to pieces. One of the men employed on the works had occasion to let the gas out of one holder into another, and he inadvertently turned the wrong valve, which caused a rush of gas through the pipes, leading to the exhauster undergoing repair, and the result was the explosion. It is rather mysterious how the explosion itself occurred, as there were no lights about; but some distance away from the engine-house there is a boiler, and the probability is that some of the gas found its way to the fire. Mr Ball questioned the men strongly as to whether they had any lights in the room; and they said most positively that they had not. The damage to the property will probably not exceed £50.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 588.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Apr.	10½	Alliance & Dublin 10 p. c.	10	16—17	..	6 3 6
100,000	10	,,	7½	Do. 7 p. c.	10	11—12	..	6 5 0
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	105—107	+2	4 13 4
100,000	20	27 May	8	Bahia, Limited	20	10—12	..	13 6 8
200,000	5	12 May	7½	Bombay, Limited	5	6—6½	..	5 15 9
40,000	5	,,	7½	Do. New	4	4—4½	+¼	6 13 4
380,000	Stck.	12 Aug.	12½	Brentford Consolidated	100	212—217	..	5 10 7
150,000	,,	,,	9½	Do. New	100	163—168	..	5 10 1
220,000	20	15 Sept.	11½	Brighton & Hove Original	20	40—42	..	5 9 6
888,500	Stck.	31 Aug.	5	Bristol	100	95—100	..	5 0 0
320,000	20	29 Sept.	11½	British	20	41—43	..	5 4 8
50,000	10	31 Aug.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	,,	8½	Do. 7 p. c.	10	14½—15½	..	5 9 8
328,750	10	—	—	Buenos Ayres (New) Limited	10	6—7	..	—
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	92—95	..	6 6 4
150,000	20	12 Aug.	8	Cagliari, Limited	20	25—27	..	5 18 6
550,000	Stck.	13 Apr.	13	Commercial, Old Stock	100	235—240	..	5 8 4
165,000	,,	,,	10	Do. New do.	100	183—188	..	5 6 4
160,762	,,	15 June	4½	Do. 4½ p. c. Deb. do.	100	123—128	..	3 10 4
800,000	Stck	15 June	10	Continental Union, Limited	100	224—229	+1	4 7 4
200,000	,,	,,	7	Do. 7 p. c. Pref.	100	190—195	+2½	5 2 7
75,000	Stck.	15 Sept.	10	Crystal Palace District	100	180—185	..	5 8 1
486,090	10	28 July	10	European, Limited	10	19½—20½	..	4 17 7
354,060	10	,,	10	Do. Partly paid	7½	14—15	..	5 0 0
5,470,820	Stck.	12 Aug.	12	Gaslight & Coke, A, Ordinary	100	215—220	−1	5 9 1
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	95—98	..	4 1 7
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	257—262	+2	3 16 3
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	116—121	..	4 2 7
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	166—171	..	4 7 8
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	162—167	..	4 3 10
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	255—260	+2	3 16 11
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	150—154	..	3 17 11
1,061,150	,,	15 June	4	Do. 4 p. c. Deb. Stk.	100	118—121	+1½	3 6 1
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	123—127	+3	3 10 10
908,000	,,	,,	6	Do. 6 p. c. do	100	164—169	..	3 11 0
3,800,000	Stck.	12 May	12	Imperial Continental	100	227—230	..	5 4 4
75,000	5	15 June	6	Malta & Mediterranean, Ltd.	5	4—4½	+⅛	6 13 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5p. c. Deb.	100	106-108*	+½	4 12 7
541,920	20	15 June	5	Monte Video, Limited	20	12½—13½	+½	7 8 2
150,000	5	27 May	10	Oriental, Limited	5	8¼—8¾	..	5 14 3
60,000	5	29 Sept.	7	Ottoman, Limited	5	4—5*	+⅛	7 0 0
166,870	10	—	2	Pará Limited	10	1½—2½	..	—
				People's Gas of Chicago—				
420,000	100	3 May	6	1st Mtg. Bds.	100	106—110	..	5 9 1
500,000	100	1 June	6	2nd Do.	100	100—103	..	5 16 7
150,000	10	—	10	San Paulo, Limited	10	6½—7½	..	—
500,000	Stck.	31 Aug.	15½	South Metropolitan, A Stock	100	275—280	+3	5 10 8
1,350,000	,,	,,	12	Do. B do.	100	227—232	..	5 3 5
230,000	,,	,,	13	Do. C do.	100	240—245	..	5 6 1
725,000	,,	14 July	5	Do. 5 p. c. Deb. Stk.	100	140—144	..	3 9 6
60,000	Stck.	31 Aug.	11½	Tottenham & Edm'nton, "A"	100	225—230	..	5 0 0
				WATER COMPANIES.				
743,952	Stck.	1 July	10	Chelsea, Ordinary	100	245—250	..	4 0 0
1,720,252	Stck.	13 Apr.	8	East London, Ordinary	100	197—202	+1	3 19 2
544,440	,,	1 July	4½	Do. 4½ p. c. Deb. Stk.	100	140—144	..	3 2 6
700,000	50	1 July	8½	Grand Junction	50	99—103	..	3 17 8
708,065	Stck.	12 Aug.	11	Kent	100	260—265	..	3 19 3
1,043,800	100	1 July	9½	Lambeth, 10 p. c. max.	100	215—220	..	4 6 4
406,200	100	,,	7½	Do. 7½ p. c. max.	100	190—194	..	3 17 3
279,700	Stck.	29 Sept.	4	Do. 4 p. c. Deb. Stk.	100	122-125*	..	3 4 0
500,000	100	12 Aug.	12½	New River, New Shares	100	320—330	..	3 13 6
1,000,000	Stck.	28 July	4	Do. 4 p. c. Deb. Stk	100	128—132	+1½	3 0 7
902,300	Stck.	15 June	6½	S'thwk & V'xhall, 10 p. c. max.	100	144—149	..	4 7 3
126,500	100	,,	6½	Do. D 7½ p. c. do.	100	134—138	..	4 14 3
1,155,066	Stck.	15 June	10	West Middlesex	100	240—245	+4	4 1 7
						*Ex div.		

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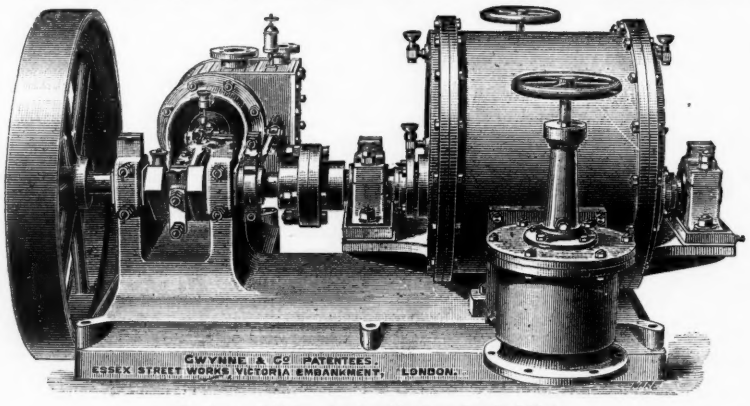

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TO GAS ENGINEERS AND CONTRACTORS.

REQUIRED an engagement as Retort- SETTER; 25 years' practical experience. Well up in Regenerative, Tar, Coke, and Breeze Fires.
Address W. ROBUS, 6, Gresham Villas, CATFORD, S.E.

WANTED, by a Young Man, a Situation as GAS-FITTER. Accustomed to Inside and Outside Work, Main and Service laying, and Meter Index taking.
Apply to J. BISHOP, Pendre, BRECON.

WANTED, by a young married Man (abstainer), a SITUATION as WORKING MANAGER of Gas-Works, making about 10 millions. Has held present Colonial Management over three years, in which he has Engine, Exhauster, &c., under his charge. Could be disengaged in about Three Months.
Address No. 2141, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Working MANAGER of Small, or FOREMAN of large Works. Have held both positions. Practical Mechanic, used to Gas-Works Machinery, Mains, Services, Meters, &c., with knowledge of Sulphate Manufacture. Testimonials and References.
Address No. 2146, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SULPHATE OF AMMONIA AND SULPHURIC ACID.

MAN (aged 32), thoroughly experienced in making above, is open for an Engagement. Capable of taking entire charge. First-class references from present employers.
Apply, by letter, to No. 2147, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, immediately, three good GAS STOKERS for the Winter Months. Total abstainers preferred.
Apply, stating age and enclosing references, to Mr. R. W. BRETT, Manager, Gas-Works, HERTFORD.

WANTED, a steady Man as Stoker.
Used to Shovel Charging. Preference given to one having a knowledge of Engine and Exhauster. Wages, 24s. per week.
Apply, with testimonials, to the MANAGER, Gas-Works, BEXHILL.

BOROUGH OF MACCLESFIELD.

WANTED A MANAGER AND ENGINEER FOR THE GAS-WORKS.
SALARY, £200 PER ANNUM.

THE Person appointed will be required to devote the whole of his time to the duties, and, in addition to taking charge of the Manufacturing Department, will have the Superintendence of the Laying of Mains, the Services, the Public Lamps, and the entire Distribution of Gas.
Applications, with not more than three recent testimonials, to be sent to me not later than Oct. 15, endorsed "Gas Manager."
Canvassing members of the Council is a disqualification.
Dated this 28th day of September, 1892.
(Signed) W. FREDK. TAYLOR,
Town Clerk.
Exchange Chambers, Macclesfield.

FOR SALE—A perfectly new 20,000 cubic feet per hour EXHAUSTER, with Steam-Engine combined, including Hydraulic Gas Governor, Bye-Pass Valves, and Connections.
For further particulars, apply to Mr. T. G. MARSH, 41, Corporation Street, MANCHESTER.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield, AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. III., centre of JOURNAL.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock, Oldham."

MESSRS. DEBENHAM, TEWSON, FARMER, and BRIDGEWATER'S MONTHLY LIST of Shops, Show-Rooms, Factories, and Waterside Premises, suitable for the Exhibition and Manufacture of Engineering and other Appliances, may be obtained, free of charge, at their Offices, 80, CHEAPSIDE, E.C.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 70, Wellington Street, GLASGOW; 58, Fountain Street, MANCHESTER; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors, for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."

MR. J. C. CHAPMAN, Fellow of the Chartered Institute of Patent Agents, advises on all matters connected with LETTERS PATENT FOR INVENTIONS and the PROTECTION OF TRADE MARKS, &c., at home and abroad. Preliminary Information and Handbook on application.
70, Chancery Lane, LONDON, W.C.

FOR SALE—Second-Hand Gas Plant:
Two Wrought-Iron CHIMNEYS, 42 ft. long, tapering from 4 ft. to 3 ft. 6 in. by $\frac{5}{8}$ in. Plates.
22 Wrought-Iron HYDRAULIC MAINS, 16 ft. by 19 ft. by 9 ft. long, with Cast-Iron Covers, having Seven holes for Dip-Pipes.
154 ∩ MOUTHPIECES, Tangye's patent Lids, 20 in. by 16 in.
18 6 in. GAS-VALVES.
One Horizontal Tangyes' ENGINE, with EXHAUSTER combined, to pass 20,000 cubic feet per hour.
Also a lot of H-PIPES and ASCENSION and DIP PIPES.
For further particulars, apply either by letter, or personally, to Mr. B. W. SMITH, Engineer, Gas-Works, SMETHWICK.

CORPORATION OF LEICESTER.

SULPHURIC ACID.

THE Gas Committee of the above Corpo- ration are prepared to receive TENDERS for the supply of SULPHURIC ACID, made either from Native Sicilian Brimstone, Recovered Sulphur, or Pyrites. Specific Gravity in each case to be stated.
The price to include free delivery by Rail into elevated Tanks (27 feet high) at the Chemical Works, Aylestone Road Gas-Works.
Probable quantity, about 1200 tons, to be delivered as required during the ensuing Twelve Months.
Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Acid," to be delivered at these Offices not later than Eleven o'clock a.m., on Saturday, Oct. 8.
The Committee do not bind themselves to accept the lowest or any tender.
ALFRED COLSON, M.Inst.C.E.,
Engineer and Manager.
Gas Offices, Millstone Lane, Leicester,
Sept. 22, 1892.

BOROUGH OF NELSON.

(GAS DEPARTMENT.)

THE Gas Committee of the above Cor- poration invite TENDERS for the construction and erection of a FOUR-LIFT GASHOLDER, 150 feet diameter, at their Brierfield Works.
Plans and Specifications can be seen at the Office of the Engineer, Mr. W. Foster, Gas-Works, Nelson.
Form of Tender may be obtained from the Engineer on deposit of Three Guineas, which will be returned on receipt of a *bonâ fide* tender.
Sealed tenders, endorsed "Gasholder," and addressed to Mr. R. M. Prescott, Town Hall, Nelson, to be sent in on or before Saturday, the 22nd day of October, 1892.
The Committee do not bind themselves to accept the lowest or any tender.
By order,
R. M. PRESCOTT,
Town Clerk.
Town Hall, Nelson,
Sept. 30, 1892.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE, BAKER, & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore.
Particulars and price, apply to Mr. T. L. ARCHER, Cathedral Chambers, Half Street, MANCHESTER.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

LIQUOR and Tar wanted.
BROTHERTON AND CO., Ammonia and Tar Distillers, LEEDS and WAKEFIELD.

OXIDE OF IRON. Genuine Natural Bog ORE. QUALITY AND CONDITION GUARANTEED. Any quantity supplied at lowest rates.
D. M. NELSON AND SONS, 68, Bath Street, GLASGOW. Telegraphic Address: "Gas, Glasgow." Depôts throughout England and Scotland.

DRAWINGS, Tracings, Specifications, Quantities, &c., prepared by an experienced Gas Engineering Draughtsman. Plans of Works made, copied, or enlarged. Blue copies. Illuminated Addresses in first-class style. Writings of all kinds, Engrossments, &c.
Address J. L. FEATHERSTONE, 173, Fentiman Road, LONDON, S.W.

FRIEDRICH LUX, Ludwigshafen am Rhein; and at No. 142, Great Portland Street, London, W.
LUX'S Gas Regulators for every consumption.
LUX'S single-stem Pressure-Gauges.
LUX'S Regulator for Gas-Engines.
LUX'S Gas-Balance.
LUX'S new Gas Regulator for Inverted Lamps and other Apparatus for Gas Lighting, &c.

BOROUGH OF DARLINGTON.

THE Gas-Works Committee invite Offers for the purchase of about 130 tons of SPENT OXIDE (Bog Ore), guaranteed to contain not less than 50 per cent. of Sulphur.
Tenders, endorsed "Tender for Spent Oxide," to be sent to me not later than the 20th inst.
No pledge is given that the highest or any offer will be accepted.
By order,
F. T. STEAVENSON,
Town Clerk.
Darlington, Oct. 3, 1892.

ROCHESTER, CHATHAM, AND STROOD GAS-LIGHT COMPANY.

SUPPLY OF COALS.

THE Directors of the above Company invite TENDERS for the supply of 30,100 tons of GAS COALS, to be delivered between the 1st of November next and the 31st of July, 1893.
Particulars and copy of Form of Tender and Contract may be had on application to
WILLIAM SYMS,
Secretary and Manager.
Gas Office: 58, High Street, Rochester,
Sept. 22, 1892.

TO TAR DISTILLERS AND OTHERS.

THE Directors of the Romford Gas and Coke Company, Limited, are prepared to receive TENDERS for the surplus TAR produced at their Works for One, Two, or Three years, commencing the 1st of October.
The Tar will be delivered into the Contractor's Tank-Vans or Tank-Trucks on the Siding, in connection with the Great Eastern Railway.
Offers to be at per gallon.
Sealed tenders, endorsed "Tender for Tar," addressed to the Chairman, to be sent in not later than the 14th inst.
The Directors do not bind themselves to accept the highest or any tender.
By order,
HY. JOHNSON,
Secretary.
Gas-Works, Romford, Essex,
Oct. 1, 1892.

IMPORTANT ISSUE OF NEW DEBENTURE STOCK IN THE BRISTOL GAS COMPANY.

GEO. NICHOLS, M. SMITH, & ALDER are instructed to sell by PUBLIC AUCTION, at their Sale-Room, 49, Broad Street, Bristol, on Wednesday, the 12th day of October, 1892, at 2.30 p.m. precisely, in lots of £100 each.

£31,300
NEW DEBENTURE STOCK
of and in
THE BRISTOL GAS COMPANY,

Created and issued in manner prescribed by the Bristol Gas Act, 1891, bearing Interest at the rate of 4 per cent. per annum, payable half yearly in June and December.
The Stock will be sold and registered in the Books of the Company free of every expense to Purchasers thereof.
Full particulars and Conditions of Sale may be obtained of the AUCTIONEERS, 49, Broad Street, BRISTOL; Messrs. BRITTAN, LIVETT, AND MILLER, Solicitors, Albion Chambers, BRISTOL; or of
JOHN PHILLIPS,
Secretary.
Chief Offices, Canons' Marsh,
Bristol.

SALE OF NEWPORT (MON.) GAS SHARES UNDER THE PROVISIONS OF THE COMPANY'S ACT, 1886.

MR. RICHARD B. EVANS has received instructions from the Directors to SELL by PUBLIC AUCTION, at the King's Head Hotel, Newport, on Wednesday, the 12th day of October, 1892, at Three o'clock in the Afternoon punctually, 100 CLASS "C" SHARES OF £100, in Lots of One Share each.

The Statutory Dividend is 7 per cent. per annum.

Particulars and Conditions may be had on application to the AUCTIONEER, No. 30, Bridge Street, NEWPORT; or to Mr. EDWARD F. MARFLEET, Secretary, at the Offices of the Company, Newport, MON.

Dated Sept. 20 1892.

CROYDON COMMERCIAL GAS AND COKE COMPANY.

SALE BY TENDER OF 500 ORDINARY £10 SHARES,

Being a portion of Additional Capital authorized to be raised under the powers of the Croydon Gas Act, 1877.

MINIMUM PRICE, £22 PER SHARE.

THE Directors give notice that they will be prepared to receive—not later than Eleven o'clock on the Morning of Wednesday, the 12th of October, 1892—sealed TENDERS for 500 ORDINARY £10 SHARES, to be paid up in full on or before the 31st of October, 1892, from which date Dividend will commence to accrue.

The last Dividend paid upon this class of Shares was at the rate of 11 per Cent. per Annum.

One Share, or any number of the 500 £10 Shares, may be tendered for, and the respective Share or Shares will be registered in the names of the purchasers, or their nominees, free of expense.

Printed Particulars and Conditions of Sale, and Form of Tender, can be obtained at the Offices of the Company, Katharine Street, Croydon.

WILLIAM J. RUSSELL, Secretary.

Sept. 7, 1892.

SWANSEA, GLAMORGANSHIRE.

IMPORTANT SALE OF SWANSEA GAS SHARES.

JOHN M. LEEDER AND SON will offer for Sale BY PUBLIC AUCTION (pursuant to the provisions of the Swansea Gas Order, 1888), at the Mackworth Arms Hotel, Wind Street, Swansea, on Friday, Oct. 7, 1892, 500 NEW ORDINARY 7 per cent. SHARES 1888, of £25 each, in the Swansea Gaslight Company, being part of the Additional Capital the Company is authorized to raise by the Swansea Gas Order, 1888.

The Shares will be entitled to Dividend at the rate not exceeding 7 per cent. per annum, and will rank equally in respect thereof as part of the Original Capital of the Company. All the Lots will be sold with the right to Dividend accruing as from the 1st day of October, 1892. The Company have for many years paid full Maximum Dividends; and they have a large Reserve Fund, which is available for maintaining such Dividends.

Sale to commence at Half-Past Two o'Clock in the Afternoon.

For further particulars and Conditions of Sale, apply to Mr. THORNTON ANDREWS, Secretary, Gas-Works, SWANSEA; or to the AUCTIONEERS, at their Offices, Goat Street, SWANSEA.

NOW READY.

GAS AND WATER CO.'S DIRECTORY, 1892.
Sixteenth Annual Issue, 5s.

GAS-WORKS STATISTICS, 1892.
Fourteenth Annual Issue, 3s. 6d.

WATER-WORKS STATISTICS, 1892.
Twelfth Annual Issue, 2s. 6d.

Handsomely Bound in One Vol., Price 10s.

LONDON: HAZELL, WATSON, & VINEY, Ltd., 1, CREED LANE, E.C.

UNEQUALLED

Gas Companies are solicited to try Samples of the

MIRFIELD
BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on application.

ROSEWELL BOGHEAD.

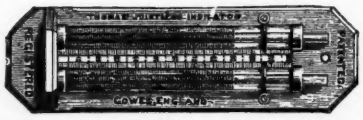
Yield of Gas per ton . . . 13,215 Cub. Ft.
Illuminating Power . . . 37·56 Candles.

GAVIN PAUL & SONS,
CANNEL COALMASTERS,
EDINBURGH.

AUG. KLÖNNE,
DORTMUND (GERMANY).

REGENERATIVE FURNACES.

Unsurpassed in
Efficiency, Economy, Durability, and Easy Working.



THOMAS'S JOINTLESS GAS GAUGES.
COWES, I.W.
American Patent for Sale.

NEWBATTLE CANNEL.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

THOMAS TURTON
AND SONS, LIMITED,
Sheaf & Spring Works,
SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.

London Office:
90. CANNON STREET, E.C.

THOMAS ILLINGWORTH,
NORTH DEAN CHEMICAL WORKS,
Near HALIFAX,
MANUFACTURER OF SULPHURIC ACID
OF EXTRA QUALITY FOR MAKING
WHITE SULPHATE OF AMMONIA.

TAR, LIQUOR, AND SPENT OXIDE
Purchased for Cash against Delivery.

JAMES OAKES & Co.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

CAST-IRON PIPES
FOR GAS AND WATER.

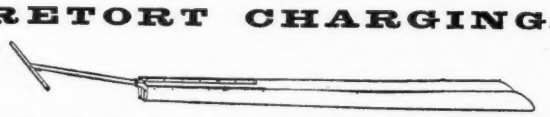
Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T pieces, and Specials ready for despatch on receipt of Order.

VALVES
FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."
WM. MACLEOD & CO.,
56, ROBERTSON STREET, GLASGOW.

T.B.KITTEL, SHEFFIELD.
CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL
ENGLISH & SCOTCH CANNELS.
REAL SILKSTONE GAS COAL
ANALYSIS AND PRICES ON APPLICATION.
T.B.KITTEL, SHEFFIELD.

STEEL SCOOPS
FOR
RETORT CHARGING.



Scoops supplied with or without handles, and of any dimensions or shape required.

HENRY SYKES, Engineer,
66, BANKSIDE, LONDON, S.E.

Now Ready. Price One Shilling.

METROPOLITAN WATER SUPPLY.
CONSIDERATIONS AFFECTING THE
ADEQUACY AND CONTROL
OF THE
WATER SUPPLY TO THE METROPOLIS.
BY
E. H. STEVENSON and E. K. BURSTAL, M.M.Inst.C.E.

LONDON:
WALTER KING, 11, Bolt Court, Fleet Street, E.C.

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

ARMSTRONG'S
PATENT
CANDLE SAFETY LAMPS.
Are a great improvement on Oil, giving a good Light requiring little or no Cleaning, and when once lighted no further attention is necessary. The Candles are made to burn 5, 7, or 9 hours.

43, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

TAR AND LIQUOR PURCHASED.

JOHN CLARKSON MAJOR,
(Established 1851,)
Tar Distiller and Manufacturing Chemist,
WOLVERHAMPTON.
SCULCOATS, HULL.

FIRE-BRICKS.
FIRE-CLAY.

JAMES WHITE & Co., Limited,
Albert Oil-Works,
WIDNES, LANCASHIRE,
Sole Proprietors of the Largest and Purest Beds of Fire-Clay in England.

FOR GAS FURNACES our GANNISTER and SILICA FIRE-BRICKS are acknowledged to be the best and most durable in the market.

GANNISTER and SILICA FIRE-CLAY guaranteed of the Purest and Finest Quality.

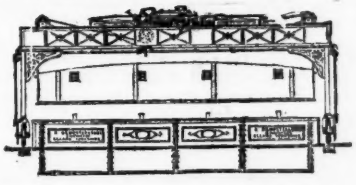
ANALYSIS AND REFERENCES ON APPLICATION.

HOLMSIDE GAS COALS.
(Wrought out of Holmside and South Moor Collieries.)

PRESENT production nearly 3000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16½ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of over
400,000 Tons per Annum.

Full particulars on application to
MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

ALEXANDER RUSSELL & CO.,
Cannel and Gas Coal Merchants,
53, WATERLOO STREET,
GLASGOW.

DEMPSTERS'

PURIFIERS (MACHINED JOINTS)
PURIFIERS.
ELLAND.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time labour, and expense.
For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, 22, Alwyne Road, Canonbury, LONDON, N.
Prices are Reduced.

MEIKLEJOHN'S PATENT
Improved Slide-Valve Anti-Dip.
Is perfectly reliable in action, and requires no attention. Has all the advantages of the Dip and Anti-Dip combined.
Is cheap and easily fixed to any form of main.
Will be found the most efficient appliance of the kind yet introduced.
Further particulars and price from
C. MEIKLEJOHN,
OLDBURY, BIRMINGHAM.
(Late N. MEIKLEJOHN, Longwood.)

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for
CANNEL & COAL.

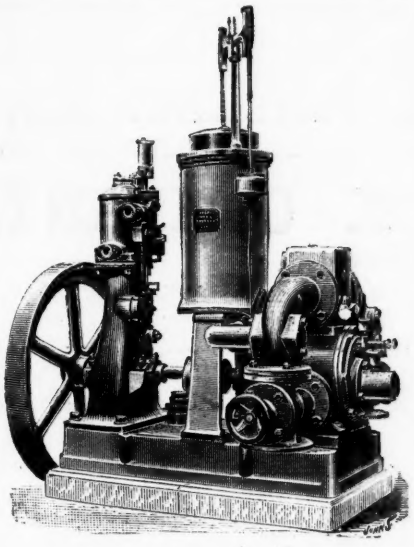
TYNE BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

For Prices and complete Analysis, apply to
YOUNG, DANCE, & CO.,
COAL OWNERS, NEWCASTLE-ON-TYNE,
Or E. FOSTER & CO., 21, John St., Adelphi, LONDON, W.C.



WALLER'S PATENT COMBINED GAS ENGINE AND EXHAUSTER
WITH
Disc-Valves, Automatic Bye-Pass Valve, Throttle-Valve, and Regulator,
COMPLETE ON ONE BASE PLATE.
Designed chiefly for sizes from 500 to 15,000 feet per hour.
CAN BE SEEN IN ACTION AT ADDRESS BELOW.

EXHAUSTERS OF ANY SIZE
COMBINED WITH GAS-ENGINES (now made to vary in speed).

ENGINES & EXHAUSTERS RUN AT DIFFERENT SPEEDS.
Waller's Washer-Scrubber with Wood Clusters.
ELEVATING AND CONVEYING MACHINERY FOR COAL, COKE, &c.

G. WALLER & CO.,
58, PARK STREET, SOUTHWARK (SURREY SIDE OF SOUTHWARK BRIDGE).

ALEX. C. HUMPHREYS, M.E.,
General Superintendent & Chief Engineer,
The United Gas Improvement Company, U.S.A.

A. G. GLASGOW, M.E.,
Late General Inspector,
The United Gas Improvement Company, U.S.A.

HUMPHREYS & GLASGOW,

Contracting Engineers for Water Gas Plant,
9, Victoria Street, London, S.W.

GAS COAL.

BEST
REAL OLD SILKSTONE GAS COAL,
Address THE STRAFFORD COLLIERIES COMPANY,
Near BARNSLEY, SOUTH YORKSHIRE.

INCLINED RETORTS,

FIRE BRICKS,
LUMPS, TILES,
BLOCKS, &c.

Special Bricks for Intense Heats.

GAS RETORTS.

CASTINGS AND EVERY REQUISITE FOR GAS-WORKS.

MOBBERLEY & PERRY,
Fire-Brick Works, STOURBRIDGE.

☞ **Retort Setters sent to any part of the Kingdom.**

G. J. EVESON,

GAS COAL AND CANNEL CONTRACTOR,

PATENTEE OF
A Special Compound for the cure of Stopped Ascension-Pipes. A couple of charges will clear a stopped Pipe, and an occasional charge keeps them clean; also increases the Make per ton and the Illuminating Power.
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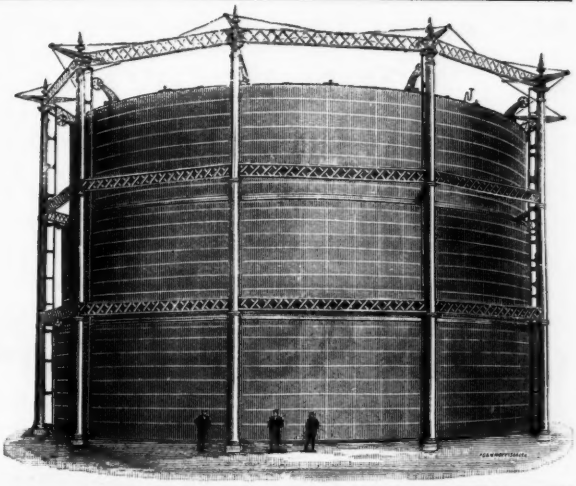

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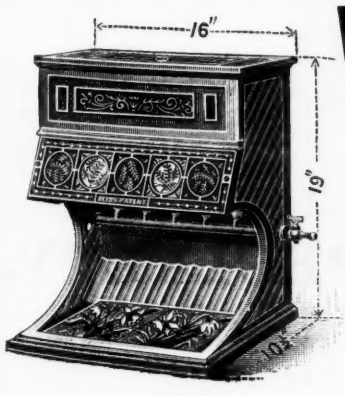

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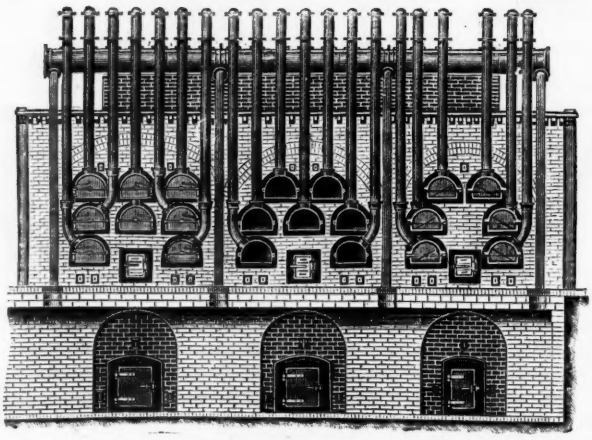

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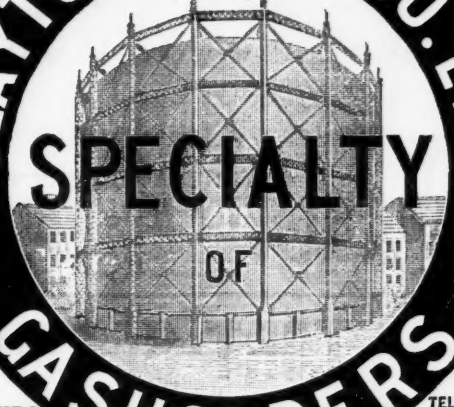

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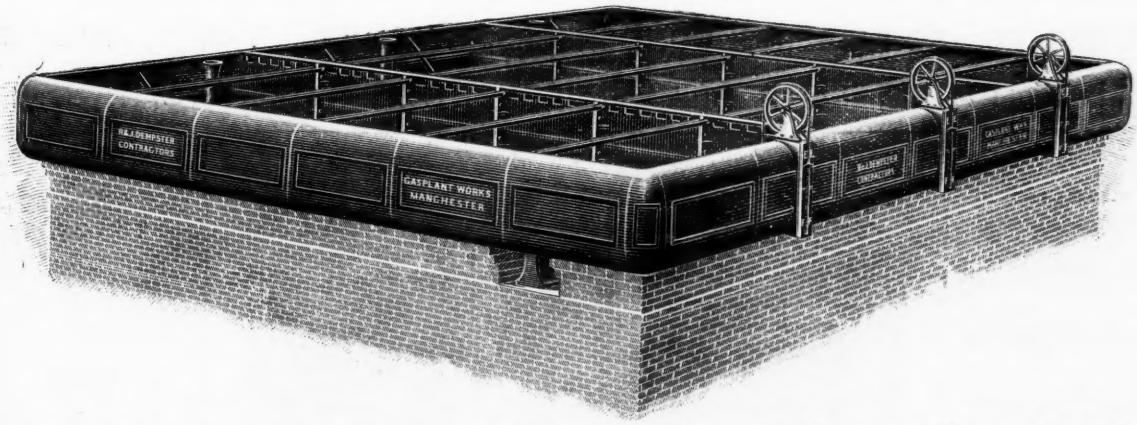

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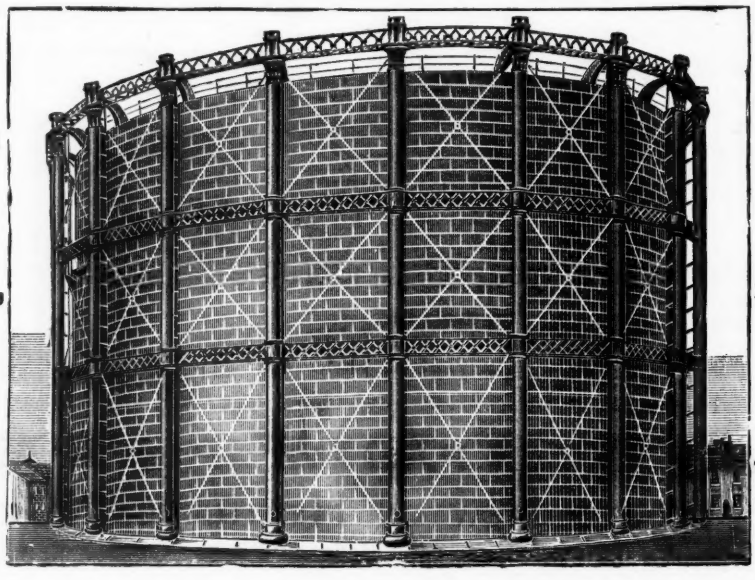

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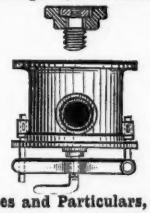

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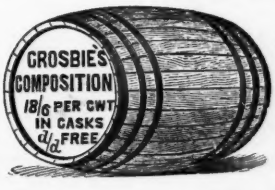

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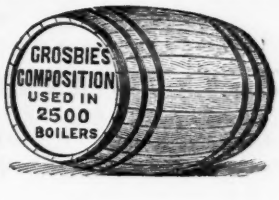

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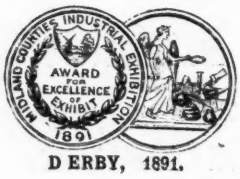

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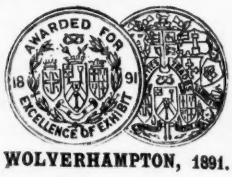

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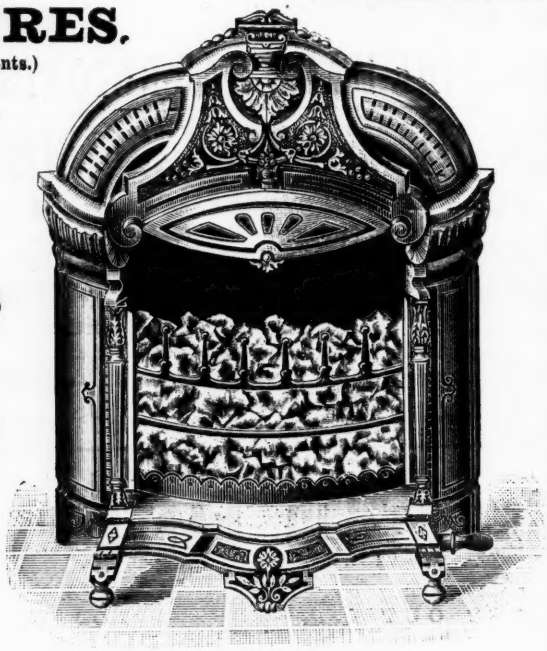

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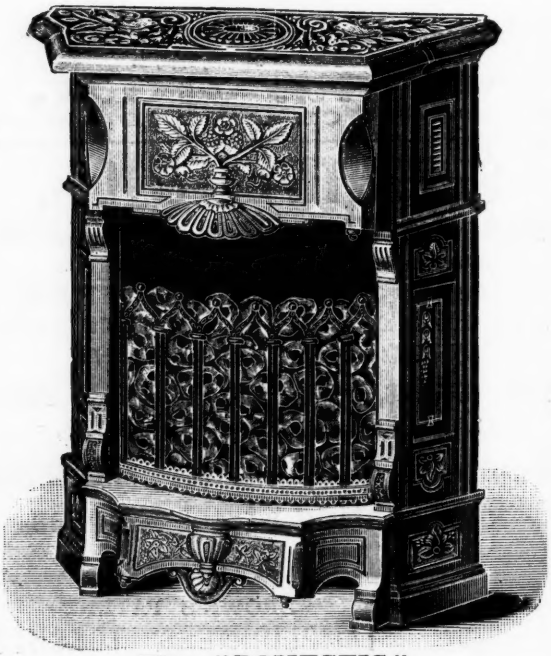

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[See also Advt., p. 584.

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